Cognitive Aspects of Decision-Making Project Summary

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EXECUTIVE SUMMARY

This final report summarizes the activities and major findings of the Cognitive Aspects of Decision-Making (CADM) project. This project identified cultural variations in situation assessment decision-making by combining extant research on cultural dimensions with findings based on empirical data collected during this project. Decision and information processing variables were characterized in relation to specific cultural dimensions to generate a greater understanding of how people with different cultural backgrounds make decisions in a dynamic information environment.

CONCEPTUAL BACKGROUND

Cultural differences in decision-making were conceptualized according to the perspective provided by researchers in social psychology and anthropology. According to this view, values form the core characteristics of cultures and can be used to analyze differences among cultural groups. Five cultural dimensions provided the primary conceptual framework for defining cultural groups and interpreting project findings: Uncertainty Avoidance, Masculinity–Femininity, Power Distance, Individualism–Collectivism, and Confucian Work Dynamism. Project research established that these dimensions could be related to measurable differences in several decision variables including likelihood estimates, confidence ratings, decision heuristics, source credibility, and organizational factors. Systematic culture-specific patterns of information processing were identified based upon these five cultural dimensions.

MAJOR FINDINGS

Decision variables were evaluated in relation to the five above-mentioned cultural dimensions to characterize cultural differences in situation assessment. Three laboratory experiments and one survey questionnaire collected the empirical data that served as the basis for the findings.

Degraded Information

The first two experiments investigated the effect of degraded information on situation assessment. Two types of degraded information were evaluated: information quality and information loss. Participants' judgments were more accurate in the higher information quality or the lower information loss conditions. Differences among cultural groups were noted for event likelihood estimates and confidence in those estimates. These differences were influenced by the type (quality or loss) and amount of information disruption, indicating that cultural factors interacted with the information used to reach a decision. The cultural dimensions used to characterize the groups implicated tolerance for uncertainty, authority relationships, and the degree of individualism present in a culture as factors contributing to these differences.

Decision Heuristics

A survey questionnaire assessed cross-cultural differences in the use of decision heuristics. Decision heuristics are information processing strategies that people frequently use when dealing with complex, uncertain, or unreliable situations. Ideally, heuristics simplify the decision process while permitting a valid inference. On some occasions, however, decision heuristics are misapplied, resulting in systematic judgmental biases that serve as the basis for inappropriate actions. The results of this survey indicated that persons from different cultural groups use decision heuristics, but in

different ways. Furthermore, these differences could be systematically related to the five cultural dimensions being used to distinguish variations in decision-making.

Source Credibility and Rank Status

The second experiment investigated the influence of message content, rank status, and source credibility on situation assessment. All cultural groups increased likelihood estimates of a specific event as more messages about the developing situation were reviewed. However, different cultural groups differed significantly in the rate at which their likelihood estimates increased. Participants were most influenced by the messages they received in the first half of the experiment regardless of whether or not those messages came from high or low credibility sources. The rank status manipulation found that, across cultural groups, the most common strategy for resolving decisional conflicts was a "majority rules" heuristic in which the participant's initial assessment was changed only when superior and subordinate disagreed with the participant.

DATABASE DEVELOPMENT

This project developed a searchable online research tool for analyzing decision-making situations. The tool features a database that organizes decision-making information from various sources, including this project's empirical data collection efforts, related technical and scientific literature, and documented events in operational settings. The project developed a search engine for accessing information from this database according to the needs of a particular decision analysis task. The tool was designed as a decision support system that organizes findings about decision-making to support command and control development.

FUTURE PLANS

Project findings have increased understanding of cultural differences in situation assessment. These findings can enhance database development so that specific cultural characteristics can be evaluated in relation to decision-making variables. Future research should build on project findings by investigating in more detail the relationship between cultural dimensions and decision biases, source credibility, and organizational structure.

Several different levels of detail could be built into the database, making it suitable for a wider array of purposes. A 'bot' software tool will continually populate the database. An advantage in using a bot is finding patterns in large amounts of data and information. Results from the experiments and questionnaire study have uncovered significant relationships among cultural, decision-making, and organizational variables. A bot can search for information sources that provide additional detail regarding the relationships among these variables.

CONTENTS

Figures

Tables

INTRODUCTION

This report documents the major findings and accomplishments of the project, Cognitive Aspects of Decision-Making (CADM). This project investigated cultural factors in the context of situation assessment decision-making. Although decision-making has been closely studied by researchers in command and control (C^2) decision-making, cultural variations in decision-making have rarely been discussed. This project investigated cultural variations on several decision variables, including information quality, information loss, source credibility, rank status, and organizational structure. The project also examined cultural differences in decision heuristics. To organize and make accessible project findings, the project developed a searchable online database and research tool. This tool is a prototype to develop intelligent decision aids that not only supply user-requested information, but also direct the user to additional task-relevant information and suggest courses of action.

BACKGROUND

Understanding cultural differences in decision-making is vital in a world where national interests are increasingly dependent on effective interaction with individuals and organizations from diverse cultures. Multi-national coalition forces in war and peacetime operations underscore that consideration of the cultural differences that exist among these forces is important. Failure to do so can hamper collaborative decision-making, delay the initiation of operations, degrade task performance, and compromise mission outcome.

Cultural Dimensions

A literature review completed early in the CADM project established that five value-based cultural dimensions play a central role in differentiating cultural groups: Individualism–Collectivism, Uncertainty Avoidance, Power Distance, Masculinity–Femininity, and Confucian Work Dynamism. Together, these five dimensions characterize individuals as culturally based differences in values and behavior patterns that help account for variations in decision-making across cultural groups. Research by Hofstede (1980, 1983, 1991), the Chinese Culture Connection (1987), and Schwartz (1994) converges to the view that these dimensions influence decision-making processes and outcomes in a systematic and relatively predictable manner. Independent researchers using different methods to measure culture arrived at similar findings, indicating that these cultural dimensions exert widespread influence. The empirical data collection efforts and literature review focused on these dimensions and their relation to decision-making variables and decision heuristics.

Decision Heuristics

Decision heuristics are information processing strategies that are often used to simplify real-world decision situations. Decision heuristics enable people to process information that is complex, uncertain, or ambiguous to reach a decision. On many occasions, heuristics facilitate formulation of an effective course of action that would otherwise require considerable additional time and effort to address. On other occasions, however, the misuse of heuristics results in systematic judgmental biases that encourage inappropriate actions and prevent the attainment of desired goals.

Research on decision heuristics has been conducted almost entirely in North America and Western Europe. Because of this narrow cultural focus, little information exists about whether and in what manner decision heuristics are moderated by cultural factors. The CADM project attempted to better define the relationships among cultural factors and decision heuristics by examining several decision

heuristics in the context of situation assessment tasks. Previous research conducted with North American and western European participants indicated that heuristics are commonly used to ease the information processing burden in complex decision situations. Efforts during the CADM project focused on extending this research to other cultural groups and comparatively analyzing findings across those groups.

PURPOSE

This project examined the relationship among cultural variables, properties of information, and measures of situation assessment. In doing so, it explored the manner in which cultural factors influence how information is processed in applied decision-making situations.

SCOPE

This project examined the influence of cultural dimensions on selected aspects of decision situations, including information quality, information loss, source credibility, organizational structure, and rank status. Interest centered on determining whether cross-cultural differences in decision-making could be related to differences in cultural dimensions.

OBJECTIVES

Project objectives included the following:

- Describe how people from different cultural backgrounds respond to ambiguous and conflicting information to assess a developing situation

- Determine how selected cultural, cognitive, and organizational variables influence situation assessment

- Determine whether decision heuristics are present in different cultures and, if so, describe any variation in their expression

- Develop a database that can be used to access information on cross-cultural differences in decision-making

ORGANIZATION

The Theoretical Foundations section describes the conceptualization of culture that guided the design and interpretation of the empirical studies performed during this project. This section also contains a discussion of decision heuristics and their relation to these cultural dimensions. The General Methodology section outlines the procedures, methods, and techniques used to collect data in the three laboratory experiments and one questionnaire study that were conducted during the project. The Results section summarizes the results of the experiments and questionnaire study in their implications for understanding cultural variations in decision-making. The Database Development section presents the development of the DMART database and discusses its potential as an intelligent decision aid. Finally, the Future Plans section discusses the development of an intelligent decision aid for gathering and evaluating information on cultural differences in decision-making.

THEORETICAL FOUNDATIONS

This section describes the conceptual framework adopted by the CADM project for understanding how cultural factors influence decision-making. A fundamental issue confronted in the early stages of this project was how to best conceptualize culture to identify cultural variations in decision-making. Even though many definitions of culture have been formulated, most were too vague to be operationalized at the level this project required. Therefore, culture must be described in more specific terms. Research literature was reviewed to identify factors that are needed to conceptualize, define, and measure culture in relation to decision-making variables. It became apparent during the literature review that values are core aspects of cultures that can be used to describe and differentiate cultures.

CONCEPTUALIZING CULTURE

A review of the technical literature from the social and behavioral sciences established that anthropology and social psychology have examined cultures using empirical and theoretical viewpoints that are compatible with the aims of the CADM project. These viewpoints can be used for the comparative evaluation of cultures.

Anthropology: Culture as Learned Behavior

Anthropology, more than any other discipline, has made the study of culture its central concern. Although numerous variations exist on the way that culture is conceptualized, anthropologists agree that culture consists of learned behaviors that arise from shared social knowledge and that this knowledge is passed from one generation to the next.

From an anthropological perspective, then, the essence of culture is learned behavior that is shared among persons belonging to the same cultural group. "Culture is the set of traditional behaviors acquired through transmission from one generation to another within a discrete segment of the human race, sharing a racial or ethnic identity, a geographic location, a specified period of time, or any combination thereof"[*]. Wise et al. (1987) developed a set of criteria for identifying cultures. These criteria encompassed three areas: psychological profile, shared history, and national/regional considerations. Using these criteria, they identified several hundred cultures. This work provided a foundation for identifying culture-specific communication skills that are important for training military personnel who are temporarily deployed in a foreign culture.

Review of the anthropological literature did not yield a standard metric that could quantify differences among cultures. However, it did raise an important side issue—*level* of culture. The definition of Wise et al. (1997) emphasizes that group boundaries are a necessary cultural component. To illustrate their level of culture, four unique cultures were identified among the American peoples of the Oregon Seaboard: Yurok, Tolowa, Alsea, and Sinkyone. Culture is a social production of a group of people, but there is no "magic" to guide the researcher's choice of *group* for study. For example, cultures can be envisioned as nested in one another; while the Yuroks, Tolowas, Alseas, and Sinkyones can be considered as separate cultures, one could also consider a larger "American peoples of the Oregon Seaboard" culture.

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[*] J. C. Wise, D. L. Hannaman, P. Kozumplik, E. Franke, and B. L. Leaver. 1997. *Methods to Improve Cultural Communication Skills in Special Operating Forces.* U.S. Army Research Institute for the Behavioral and Social Sciences (Conract No. DASW01-95-K-006).

Implicit in the consideration of level of culture is an internal (i.e., culture member) identification. Additionally and practically, there is also an external (i.e., observer–researcher) identification process. This process is tied to the purpose for the study and must include consideration of losses and gains associated with the chosen classification. For example, a larger group may be less homogeneous in their beliefs, traditions, and behaviors than constituent groups that one could identify. It is acknowledged by virtually all researchers that the degree of homogeneity of beliefs, traditions, and behaviors within nations varies widely. In many cases, there is a lack of correspondence between political and cultural regions. Within nations, however, there are governing institutions and associated processes that reflect a set of values and that act as social stimuli for all people in the nation. Practical issues are also a high priority for researchers. Many types of culturally relevant data are available at the level of national institutions. In addition, classification by nation is highly relevant to collaborative humanitarian and military missions where a common delimiter is the national boundary. It is, thus, incumbent upon each researcher to consider the potential losses and gains associated with different levels of culture and to optimize them for the purposes of each study.

Social Psychology: Culture as Shared Values

The fundamental concept from anthropology that culture is learned behavior laid the foundation for the comparative study of human behavior in a cultural context (Segall, Dasen, Berry, and Poortinga, 1990). Knowledge of the ways and means of survival is passed from generation to generation. Much of the knowledge includes an evaluative component such that certain ways and means are preferred over their alternatives. Children are taught these preferences—values—early in life. A value is a conception, explicit or implicit, either specific to an individual or characteristic of a group, of the desired state which influences the selection from available modes, means, and ends of actions (Kroeber and Kluckohn, 1952). Members of cultures share many common values that are manifested both at the societal level (e.g., traditions, laws, and norms) and at the individual level (e.g., beliefs, choices). Social psychology emphasizes the relationship between behavior and socially generated stimuli such as cultural institutions, values, and beliefs. In terms of how culture influences behavior, social psychology emphasizes the role of values. It focuses on an aspect of learned behavior that is especially crucial in understanding the relationship between cultural teachings and individual behavior.

Many social scientists have recognized the central role of values in individual and group behavior. Rokeach (1973) investigated the relationship between values and behavior in various contexts. He found that values are enduring sets of beliefs that guide both thought and action. Because of their constancy over time, values can help to understand and predict the behavior of individuals and groups. Values contrast with beliefs, which are situation-specific and might fluctuate in response to ongoing events. An individual's entire value set consists of only several dozen values that form guidelines for behavior. Values facilitate stable, predictable patterns of behavior among individuals, groups, and social structures.

The task of identifying the values that are found in most cultures proved challenging. Hofstede (1980), however, created a conceptual framework that is suitable for evaluating cultures. This framework consists of a set of empirically measurable values that are important for understanding differences in both social and individual behavior.

Smith and Bond (1993) discussed the need to measure culture to account for differences observed between cultures in areas such as decision tasks. There are many cases where study results obtained in one culture have failed to be replicated in other cultures. For example, the inclusion of employees in decision-making in factories has been highly successful in increasing productivity and workers'

satisfaction in Japan. In Norway, including employees was perceived as circumventing the labor union process. In Puerto Rico, it resulted in loss of confidence in management and in high employee turnover.

To reconcile such differences, Smith and Bond (1993) emphasized the need for a "conceptual framework that will explain why one study replication might 'succeed' where another 'fails.' In other words, of all the existing differences between national cultures, which are the ones upon which we as social psychologists could most usefully focus in attempting to explain the different results of studies?" (p. 38). To answer this question, let us now turn to three lines of research in social psychology that have proposed conceptual frameworks for the comparative evaluation of cultures. Each of these lines of research has endured years of peer review, and their contribution to improved conceptualizations of culture is widely acknowledged (e.g., Peterson and Smith, 1997; Smith and Bond, 1993; and Triandis, 1993).

Hofstede. Geert Hofstede (1980) originated the first line of research. This landmark study is important to a paradigm where profiles of cultures are built from the values that their members report through a questionnaire. The database consists of 117,000 responses that were obtained from occupationally matched samples of IBM employees in more than 50 countries. Responses were collected in two rounds over a 5-year period in the late 1960s. Items were developed by Western researchers, but were designed to apply globally. Items queried respondents about their work experiences—for example, their perception of their manager's style of decision-making—and their values.

Hofstede used statistical factor analysis to identify four patterns of cultural values (dimensions) from country scores on questionnaire subscales:

- Power Distance is "the degree of inequality among people that the populace of a country considers as normal" (Harzing and Hofstede, 1996, p. 304). It is the amount of deference shown by those in subordinate positions toward those in superior positions in an organization. High Power Distance is associated with activities and attitudes such as autocratic decision-making, superiors considering subordinates as part of a different class, close supervision of subordinates, and subordinates not likely to disagree with superior's decisions. Low Power Distance is associated with egalitarian procedures (Cummings and Worley, 1994).

- Uncertainty Avoidance is the degree to which people in a country prefer structured over unstructured situations. Structured situations are those in which there are clear rules as to how one should behave, and planning and stability counter uncertainty. In a high Uncertainty Avoidance culture, people who are considered experts are given the most authority, explicit role differentiation is preferred in group interaction, adherence to rules is valued, there is considerable resistance to change, and a conservative approach is taken when dealing with ambiguous situations. Low Uncertainty Avoidance is generally associated with the corollary conditions outlined above, including higher levels of risk-taking (Cummings and Worley, 1994).

- Masculinity–Femininity is "the degree to which values like achievement, assertiveness, performance, success, and competition, which in nearly all societies are associated with the role of men, prevail over values like the quality of life, maintaining warm personal relationships, service, care for the weak, and solidarity, which in nearly all societies are more associated with the role of women" (p. 304).

- Individualism–Collectivism describes "whether one's identity is defined by personal choices and achievements or by the character of the collective groups to which one is more or less permanently attached" (Smith and Bond, 1993, p. 38). It is the degree to which one's identity is

defined by personal choices and achievements or by the character of the collective groups to which one is more or less permanently attached.

Hofstede (1980, 1983) used these four dimensions to build profiles of countries. He also performed a statistical cluster analysis to group countries by their similarity of scores on the dimensions. These profiles and groupings were relied upon in this project when interpreting cultural differences as cultural value dimensions.

Chinese Culture Connection. The second line of social psychology research investigating culture was conducted by a group of researchers who published in 1987 under the name, "Chinese Culture Connection." Their database was comprised of responses to 2300 questionnaires that were obtained from university students in 23 countries. The questionnaire items were designed to measure fundamental values in Chinese culture. Factor analysis identified four cultural patterns (dimensions) from country scores on subscales. Three of the four were highly correlated with Hofstede's (1980) Power Distance, Individualism–Collectivism, and Masculinity–Femininity dimensions. These correlations are evidence of the robustness of these dimensions across cultures.

In addition to these four dimensions, a fifth factor was identified that is closely rooted to enduring Chinese values and beliefs:

- Confucian Work Dynamism is the extent to which a person adopts a long-term orientation toward life (Chinese Culture Connection, 1987). It is a bipolar dimension consisting of values "stressed in the teachings of Confucius" (Harzing and Hofstede, 1996, p. 317). The poles are long-term versus short-term orientation.

Individualism–Collectivism, Power Distance, and Masculinity–Femininity appear relevant to understanding many types of cultures whereas Uncertainty Avoidance and Confucian Work Dynamism might be somewhat less applicable universally (Smith and Bond, 1993). Hofstede (1991) supports the inclusion of Confucian Work Dynamism in research concerned with classification of cultures by universal dimensions. The combined Hofstede–Chinese Culture Connection conceptual framework, therefore, consists of five value-oriented cultural dimensions.

Schwartz. A third line of research conducted by Schwartz (1994) generated a database based on the responses of secondary schoolteachers (considered transmitters of social knowledge) and college students in 38 national cultures in the late 1980s and early 1990s. The questionnaire was designed to measure values that are guiding principles for the behavior of individuals and groups; Western and non-Western values were incorporated.

Schwartz (1994) used smallest space analysis, a statistical procedure that shows which items cluster together, and identified seven culture-level value types:

- Conservatism reflects values associated with the maintenance of harmonious relationships within collectivistic cultures.

- Egalitarian commitment is the value that binds members of individualistic cultures to ideals of social justice and responsibility.

- Affective autonomy reflects an individualistic view of pursuit of stimulation and hedonism.

- Intellectual autonomy reflects an individualistic view of self-direction.

- Hierarchy reflects values associated with the legitimacy of hierarchical role and resource allocation.

- Mastery emphasizes active self-assertion of humans upon the environment.

- Harmony is the degree to which social agreement and with accord nature are emphasized (p. 101).

Schwartz's value types can be related to Hofstede's (1980) dimensions: Affective Autonomy, Intellectual Autonomy and Egalitarian Commitment with Individualism–Collectivism; Conservatism with Power Distance; Harmony with Uncertainty Avoidance; and Mastery with Masculinity. Schwartz's work is considered a refinement of work within the values paradigm.

Example of Cultural Dimension Configurations

To show how cultures can differ on the five cultural dimensions described above, table 1 compares the U.S. and Japan in terms of these dimensions.

Table 1. Comparison of U.S. and Japan on cultural dimensions
(adapted from de Mooij, 1998, pp. 89–91).

Cultural Dimension	U.S.	Japan
Power Distance	Low	Medium
Individualism–Collectivism	High individualism	Medium individualism
Masculinity–Femininity	High masculinity	High masculinity
Uncertainty Avoidance	Low	High
Confucian Work Dynamism	Low	High

Cognitive and behavioral differences between the U.S. and Japan can be understood and predicted based on their differences on cultural dimensions. A significant advantage of using a values-based approach to predicting behavior is that it can be applied to diverse activities. Prominent cultural behavior patterns that stem from these differences are presented in table 2 to demonstrate how such differences are expressed in individual and group behavior. Table 2 shows that the U.S. and Japan differ in time management, risk perception, perceived focus of control, authority relationships, education, social interaction, and willingness to postpone gratification. For more information about the linkages between the cultural dimensions and these behavior patterns, see de Mooij (1998, pp. 64–88). The fact that such a wide range of differences can be understood in terms of the Hofstede-Chinese Culture Connection dimensions is testimony to their validity and explanatory power.

These preferences and behavioral tendencies can be used to elicit target behaviors from individuals and groups by controlling the type and amount of information they receive. This strategy would be most effective when applied to those areas associated with the strongest preferences and tendencies. This approach is also useful for predicting how an adversary might choose to intervene against one's own group. This approach, therefore, allows for self-evaluation as well as the evaluation of other groups.

Table 2. Selected cognitive and behavioral differences between U.S. and Japan
based upon cultural dimension differences (adapted from de Mooij, 1998, pp. 89–91).

U.S.	Japan
Short-term thinking; short range schedules	Long-term thinking
Desire for change ("newer" and "better")	Dislike change
Credit card culture, not cash	Cash preferred over credit cards
Linear thinking; time is compartmentalized	Circular time concept; time is continuous
Education valued only for any competitive advantage it confers	Education has intrinsic value, independent of labor market
Education teaches critical thinking; ask "why," not "how"	Thinking means to find an answer to be shared with other; ask "how," not "why"
Private opinions expressed	Private opinions not expressed
Independence	Dependence
Strong role differentiation	Strong role differentiation
Conquest over nature	Harmony with nature

Summary

Research by Hofstede, the Chinese Culture Connection, and Schwartz converges to the view that values are major determinants of behavior. Because values are learned, this viewpoint is consistent with that of anthropology, namely, that culture is a form of learned behavior that is shared by a group of people. The fact that independent researchers using different methods to measure culture have obtained similar results indicates that the five value-based dimensions described in this section exert important effects in the lives of many people. Furthermore, although dimension profiles differ from one culture to another, they are not independent of culture, but instead help to define cultural differences. By measuring these dimensions and evaluating them in task-specific contexts, it should prove possible to better understand how they influence various activities, including decision-making.

A COGNITIVE MODEL OF DECISION-MAKING

Cognitive psychology has developed models of human information processing that describe how people encode, store, transform, and retrieve information before generating a response and receiving feedback regarding the effect of their actions on modifying the environment. This section presents a cognitive information processing model proposed by Hogarth (1987) that is especially suited for evaluating decision-making processes, outcomes, and responses. As figure 1 shows, this model is comprises of three mutually interacting elements: (1) the person performing a task, (2) the actions that are based on decisions made by the person, and (3) the task environment in which decisions, actions, and their outcomes occur and are interpreted.

This model relates decision heuristics and biases (Kahneman, Slovic, and Tversky, 1982) to four cognitive information processing stages: Information Acquisition, Information Processing, Output, and Feedback. Information Acquisition is the process of obtaining task-relevant information from the environment or recalling it from memory. Information Processing involves performing cognitive transformations on that information to facilitate a subsequent action that will contribute to completing a task. Output is the step whereby the results of cognitive operations become evident. Output can either be internal to the person performing the task or it can be expressed externally to other persons who are involved in the task or who are affected by its consequences. Referring to figure 1, action occurs within the task environment (as opposed to output, which lies at the interface of the task performer and the task environment) and is often indistinguishable to an observer from the output. Outcome arises from an action and can feed back into the task performer's schema and perhaps even the task environment itself.

Figure 2 shows human and informational components of a decision. The lines of influence of contextual variables—organizational and cultural dimensions—upon information processing variables are in the upper three boxes. Contextual variables function to "set the stage" for the decision-maker by defining the situation and the decision-maker's role within the situation. Note that the five cultural dimensions set forth by Hofstede and the Chinese Culture Connection are the cultural dimensions in this model. The decision-maker then processes information within that situation. The lower left box shows information characteristics that can influence the decision-making process. They describe characteristics of the information that is processed, and may interact with contextual and cognitive variables to affect the decision that is reached. One major goal of the research review was identification of potential interactions; findings are included as implications for interventions to affect decision-making. The following section describes how a major class of decision-making variables, decision heuristics, were conceptualized in terms of this model of information processing.

DECISION HEURISTICS

Decision heuristics are information processing strategies often used to simplify real-world decision situations that are frequently complex, uncertain, or ambiguous. Decision heuristics are frequently used when individuals must process complex, uncertain, or unreliable information. On many occasions, decision heuristics facilitate reaching an effective decision that would be difficult otherwise. On other occasions, however, decision heuristics lead to systematic judgmental biases that produce inappropriate actions. To synopsize current knowledge of decision heuristics, a review of decision heuristics was completed as part of the CADM project (Gwynne, Heacox, and Pérez, 1997). Virtually all research on decision heuristics has been conducted in North America and Western Europe. Because of this narrow cultural focus, little information exists about the manner in which decision heuristics are moderated by cultural factors.

The CADM project took an important first step toward gaining a better understanding of the relationship between cultural factors and decision heuristics. It examined several decision heuristics in the context of a questionnaire study and a laboratory experiment. By extending the investigation of decision heuristics to other cultural groups, the CADM project generated valuable findings about the cross-cultural nature of decision heuristics. These findings have important implications for understanding and predicting the decisions of persons from different cultures under various information presentation conditions.
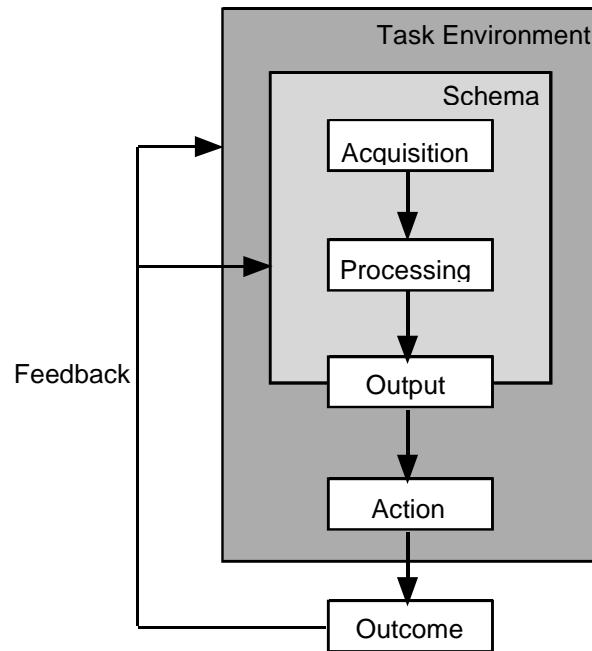
Figure 1. Information processing stage model for decision-making (from Hogarth, 1987, p. 207).
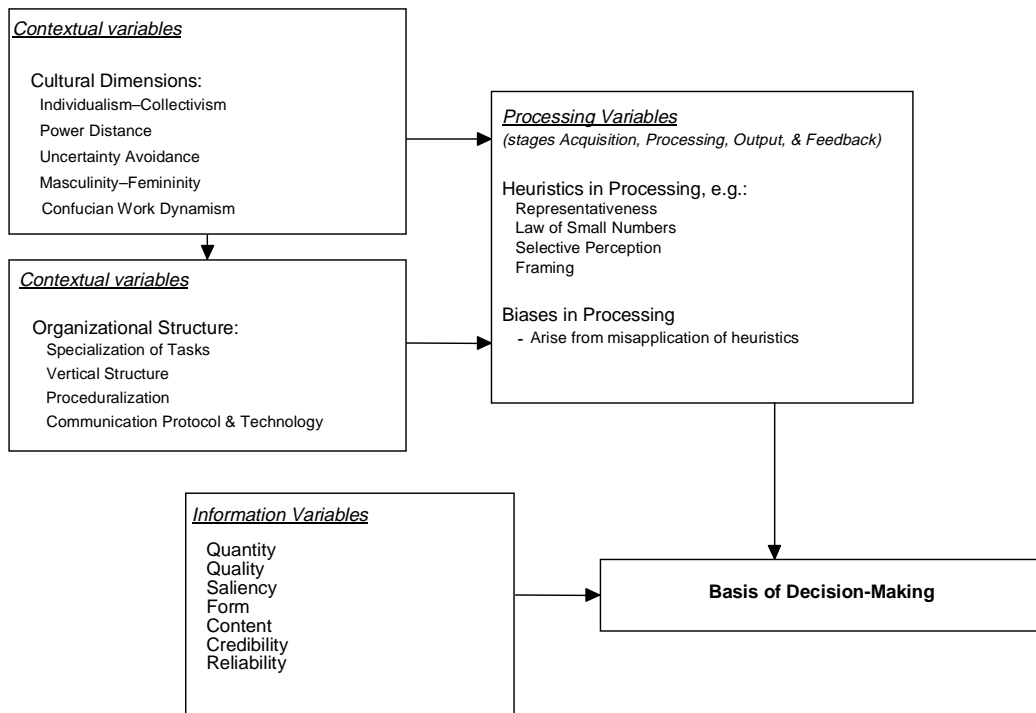

Figure 2. Variables affecting the use of information by decision-makers (adapted from O'Reilly, 1983, p. 112).

The practical implications of decision heuristics for C^2 decision-making are numerous. Information provided during the earliest stages of a developing situation is a crucial determinant of responses to later information. Biases favoring a certain decision outcome can be established by controlling the content of the information that is presented early in a decision situation. Because adjustments from the initial anchor are typically overly conservative, predictions can be made regarding intermediate and final situation assessments given knowledge of the information that is supplied after the initial information.

Decision heuristics can be described as the information processing model for judgment described in the previous section. A decision bias arises when a decision heuristic is inappropriately used, resulting in a faulty decision. Decision biases can intervene at each of the four stages of information processing contained in the model (Information Acquisition, Information Processing, Output, and Feedback). Biases tend to exert their influence differently, depending upon the stage in which they occur. Decision biases that occur in the Information Acquisition stage affect the saliency of the information that is obtained from memory or the environment. Biases in the Information Processing stage can cause inappropriate strategies (processing rules) to be applied to information and the consequent misinterpretation of that information. The Output stage can produce biases when the range of responses available to a person is restricted in some way. Biases in the Outcome stage can cause the significance of a task output to be misconstrued and interfere with learning the relationships that are needed to generate accurate predictions. Table 3 summarizes the more common decision heuristics in terms of the information processing stage at which they occur.

Several factors can influence how decision heuristics are used. The role of two of these factors, source credibility and organizational structure, was examined in one of the three experiments and the survey questionnaire. As an example of the mechanisms of influence, an overview of these factors in relation to decision heuristics is now provided.

Source Credibility

The credibility of information sources is often an important factor in determining whether information is believed and acted upon. Indeed, source credibility is more important than source expertise in determining the importance assigned to information. A small amount of information from a source perceived as highly credible is given more weight than a predominance of contradictory information from less-credible sources (O'Reilly and Roberts, 1976).

Research on the representativeness decision heuristic has contributed knowledge that aids in understanding the role of source credibility in situation assessment (Kahneman and Tversky, 1972). According to the representativeness heuristic, the likelihood of an event is estimated by the extent to which it is similar to its parent population. If properly applied, this heuristic facilitates effective decision-making. However, people sometimes fail to consider factors that are representative of a population when forming likelihood estimates, relying on more salient, but less valid, factors. For example, information sources that provide highly variable information tend to be less reliable than sources that provide more consistent information. This variability tends to make the source more salient to observers who then place undue weight on the information conveyed by that source. The end result is that lower credibility sources are relied on more than higher credibility sources. The third experiment in the CADM project examined source credibility issues in the context of situation assessment decision-making.

Table 3. Decision heuristics in relation to information processing stage
(adapted from Hogarth, 1987, pp. 216–222).

INFORMATION ACQUISITION

Availability	• The ease with which specific instances can be recalled from memory affects judgments of frequency; used when assessing the frequency of a class or the plausibility of a certain development, e.g., frequency of well-publicized events is overestimated whereas the frequency of less well-publicized events is underestimated.
	• Chance 'availability' of certain 'cues' in immediate environment influences judgment; decision-making can be hindered/facilitated by cues perceived in a particular setting (cues help to establish cognitive 'direction.'
Selective Attention	• People structure problems on the basis of their own experience/knowledge/skills.
	• Anticipations of what one expects to see bias what one does see (expectations influence perceptions).
	• People seek information consistent with their own views/hypotheses (confirmation bias).
	• People downplay/disregard conflicting evidence (e.g., people underweight information that does not fit a consistent profile).
Concrete Information	• Concrete information (i.e., vivid, based on experience/isolated incidents) dominates abstract information (base-rate statistics), e.g., anecdotal reports from individuals are given greater credence than more valid statistical information based on studies involving a large number of people.
Illusory Correlation	• Belief that two variables covary when in fact they do not.
Data Presentation	• Order effects (primacy/recency): Sometimes the first items (primacy) or the last items (recency) in a sequential presentation take on undue importance.
	• Mode of presentation (e.g., sequential versus intact displays) can affect information that is accessed.
	• Mixture of different types of information (e.g., qualitative versus quantitative) wherein only one of the types is focused on.
	• Logical data displays that omit critical information; appearance of completeness can encourage people to overlook critical omissions of information.
	• Context effects on perceived variability, e.g., absolute size of a set of numbers can affect variability estimates.
Framing	• Outcomes are evaluated as deviations from reference points or levels of aspirations; this can interact with the way people evaluate outcomes that are 'framed' as losses or gains and produce choice reversals.

INFORMATION PROCESSING

Conservatism	• Failure to revise opinion on receipt of new information to the same extent as Bayes' theorem (can be offset by 'best guess' strategy to produce optimal performance with unreliable information sources).
Non-Linear Extrapolation	• Inability to extrapolate growth processes (e.g., exponential) and tendency to underestimate joint probabilities of several events.

Heuristics Used to Reduce Mental Effort

Anchoring and Adjustment	• Prediction made by anchoring on a value and then adjusting to allow for circumstances of present case; often used in numerical prediction when a relevant value is available, e.g., making predictions using a prior prediction and adjusting it by an arbitrary value.
Representativeness	• Judging likelihood of an event by estimating the degree of similarity to the class of events of which it is supposed to be an exemplar, e.g., occupational stereotyping people on the basis of their appearance.
Law of Small Numbers	• Characteristics of small samples are deemed to be representative of the populations from which they are drawn; consequently, too much weight is given to small sample results (which are more likely to be atypical than large sample results).
Justifiability	• A 'processing' rule can be used if an individual finds a rationale to 'justify' it even if its use is inappropriate for the situation.
Best Guess Strategy	• Tendency to discount the uncertainty inherent in many information sources; Under conditions involving several sources of uncertainty, simplification is made by ignoring some uncertainties and forming a judgment on 'most likely' hypothesis.

Decision Environment

Complexity	• Complexity induced by time pressure, information overload, distractions lead to reduced consistency of judgment, e.g., decisions made under time pressure may involve little information processing.
Emotional Stress	• Can reduce care with which people select and process information.
Social Pressures	• Judgments of individuals can be unduly influenced by the majority view of a group of people.

OUTPUT

Response Mode

Question Format	• The way a person is required or chooses to make a judgment can affect the outcome.
Scale Effects	• The scale on which responses are recorded can affect responses.
Illusion of Control	• Activity concerning an uncertain outcome can induce feelings of control over the uncertain event (e.g., planning can induce a sense of control over uncertain future events).

Table 3. Decision heuristics in relation to information processing stage.
(adapted from Hogarth, 1987, pp. 216–222). (continued)

FEEDBACK

Misperception of Chance Fluctuations (Gambler's Fallacy)	• Observation of an unexpected number of similar chance outcomes leads to the expectation that the probability of the appearance of an event not recently seen increases.
Hindsight Bias	• In retrospect, people are not 'surprised' about what has happened in the past; they can easily formulate plausible explanations, e.g., Monday morning quarterbacking.

Organizational Factors

The effect of the social position of a source within an organization is a reliable predictor for whether or not its communications are accepted. The third experiment conducted during the CADM project also examined rank status in terms of cultural dimensions such as Power Distance and Uncertainty Avoidance. In a study of rank status influences among U.S. military personnel, Driskell and Salas (1991) found that subordinates were more likely to defer judgment to superiors, and across ranks, highly stressed team members were more deferential. As an example, consider Power Distance, the amount of deference between superiors and subordinates in an organization. It can be hypothesized that a decision-maker from a low Power Distance culture will be less likely to defer to a contradictory judgment originating from a superior than a decision-maker from a high Power Distance culture. Certain cultures depend more on the rank status of individuals and groups involved in decision-making than others do (McMillan, Hickson, Hinings, and Schneck, 1973). The U.S. and Canada, for example, tend to have more specialized rank status relationships than Great Britain. This increased specialization guides decision-making autonomy and establishes the range of authority that can be exercised by people in those roles.

GENERAL METHODOLOGY

LITERATURE REVIEW ON CULTURAL DIMENSIONS

A literature review was conducted on cultural dimensions and their relationship to decision-making early in the CADM project. This review focused on social science research literature (psychology, sociology, and anthropology), but also included other areas such as organizational behavior and business and management research. Associations between cultural dimensions and decision performance were found in the research of cross-cultural psychology, cultural anthropology, and cognitive anthropology. The business and management literature provided links between cultural dimensions and organizational factors that can affect decision-making in groups and teams.

Several online bibliographic databases were used to locate articles for the literature review, including PSYCHLIT, PSYCHINFO, Defense Technical Information Center (DTIC) and SOCIAL SCIENCE CITATION INDEX. Content searches were conducted of the library systems of the University of California, California State University, California School of Professional Psychology, San Diego, and SPAWAR Systems Center, San Diego (SSC San Diego). Review of relevant journal and professional conference indexes yielded many reports. Research document reference lists provided links to many additional articles and reports.

The search strategy for each database or index source started with key word descriptors for terms related to cultural factors. The extensive literature on culture was searched by using specific key words. Whenever possible, searches were narrowed to yield results that specifically linked cultural factors to decision-making variables.

The selected journal articles, monographs, technical reports, and chapters were organized according to major and minor topic areas. Findings, whenever possible, were recoded into recommendations for performing or refraining from specific actions that influence decision-making. Articles or books that represented a seminal contribution in the conceptualization and understanding of culture were included. An extensive compendium of several hundred current and archival research articles and monographs was gathered that discussed the role of cultural and organizational factors in decision-making. Each of these citations was coded into a database organized according to the major cultural and information processing variables that were discussed in the Theoretical Foundations chapter. This database provided an important resource for identifying issues and formulating research questions during the remainder of the project.

DEMOGRAPHIC AND CULTURAL ASSESSMENT

The CADM project included four separate data collection efforts. One was a survey questionnaire on decision heuristics and the other three were laboratory experiments that examined cultural variations in decision-making. To characterize each project participant in demographic and cultural factors, a two-part questionnaire was administered at the outset of each study. The first section of the questionnaire obtained demographic information including gender, age, education, occupation, citizenship, language typically spoken in various settings, style of food eaten, and religious background. Responses to this section were used to summarize participant demographic characteristics and to categorize participants into cultural groups based on markers of enculturation. The second section of the questionnaire assessed each participant's position on the five cultural dimensions formulated by Hofstede and the Chinese Culture Connection.

Empirical Measurement of Culture

The values paradigm generated by research in cross-cultural social psychology features cultural dimensions that are measurable. Because of this, it was decided that the values paradigm could furnish the needed structure. The research by Hofstede and the Chinese Culture Connection has endured years of peer review and its contribution to the definition and measurement of culture is widely acknowledged throughout social psychology and cultural anthropology. The four Hofstede dimensions were measured by the same items as used in Hofstede's original study (1980, 1983). Power Distance was measured with three items. Uncertainty Avoidance was measured with three items. Masculinity–Femininity and Individualism–Collectivism were measured by one set of 14 items. Confucian Work Dynamism was assessed by the same eight items that were used in Chinese Culture Connection's original study (1987).

Sampling Of Culture Types

Hofstede (1980, 1983) performed a statistical cluster analysis to group countries with similar scores for Power Distance, Individualism–Collectivism, Uncertainty Avoidance, and Masculinity–Femininity. Hofstede identified 11 culture cluster profiles based on categorizing their dimension scores into *low, medium,* and *high* categories. Because there were insufficient numbers of participants from individual foreign countries, the sampling for this project was based on Hofstede's culture clusters, which consisted of multiple countries. Profiles of the clusters were used to target cultures of interest. Based on dimension profiles from the original Hofstede studies and participant availability, culture clusters 4, 5, and 9 were determined as the most suitable for this project. Table 4 presents the predicted values of each of these clusters on the Hofstede and Chinese Culture Connection dimensions.

Table 4. Predicted culture dimension characteristics of culture clusters targeted for data collection (from Chinese Culture Connection, 1987; Harzing and Hofstede, 1996).

Cultural Dimension	Cluster 4	Cluster 5	Cluster 9
Power Distance	High	High	Low
Uncertainty Avoidance	High	Low–Mid	Low
Individualism–Collectivism	Mid I	Low I	High I
Masculinity–Femininity	Mid M	Low–Mid M	High M
Confucian Work Dynamism	High	Low–High	Low

Development of the Enculturation Index

To facilitate the placement of each participant into a culture cluster based on Hofstede's culture clusters, an enculturation index was formulated. A typical approach to cross-cultural research involves collecting data in the countries of interest. However, in this project, the sources of participants were limited to organizations located only in the U.S. This geographic limitation meant that participants would be living in the U.S., that their length of residence in the U.S. would vary greatly, and that they would be functionally proficient in the English language. For purposes of the study, however, participants were categorized into the national group to which they were enculturated (i.e., the nation that had the largest impact in shaping their values.

The literature review demonstrated that research in acculturation, defined as "acquiring the customs of an alternate (non-native) society" (Mendoza, 1989, p. 372) provided the most usable concepts for developing the enculturation index. Studies that described the development of scales of acculturation were used to identify measurable indicators of enculturation (e.g., Berry, Trimble, and Olmedo, 1986; Cuellar, Harris, and Jasso, 1980). Based on these studies an enculturation index was developed that contained the following components:

- "Home Country" is the country with which the respondent self-identifies. It is an important concept within the enculturation index and is the basis for scoring the index. Other index items are compared with the home country for prevalence or typicality; for example, there is a match and accompanying positive score on a language item for a respondent who lists *home country* as France and *language spoken at home currently* as French, but there is not a match and a zero item score for a respondent who lists *home country* as France and *language spoken at home currently* as Japanese.

- Religion: the religion with which the participant identifies.

- Citizenship: the nation of which the participant is a citizen.

- Language spoken (a) at home as child, (b) at home currently, and (c) with friends currently. (Language currently spoken at school or work is largely out of the control of the respondent.)

- Education: country where educated for (a) ages 6–12 (primary grades) and (b) ages 13–18 (secondary grades).

- Residence: Percent of life lived in home country (the ratio of total years in home country divided by the age of the participant).

- Style of food: frequency of consumption of food prepared in the style of the home country.

A cumulative score was calculated with equal weighting of the six component scores (i.e., the comparisons with *home country*), because there was no theoretical basis for differential weighting. Responses were evaluated to determine the most appropriate categorization of participant to national group. The highest possible score was 6.0. If a respondent's index score was low (less than 4.0) when item comparisons were made with reference to the home country as listed, the items were then scored with reference to other listed countries of residence. Each respondent was grouped with the country that produced the highest index score for him/her.

Participants in the Enculturation Study

A total of 280 individuals completed the cultural background questionnaire. Efforts were made to obtain a sample that represented several distinct cultural regions to discover any culturally related differences on the decision-making tasks. One hundred forty-three participants were from the U.S. and 137 participants were from the countries shown in table 5. One hundred forty-seven participants were currently graduate students serving in the military of their home country. The remaining participants were civilian undergraduate and graduate students, scientists, and employees. Participants were recruited at the Naval Postgraduate School in Monterey, California; United States International University (USIU) in San Diego, California; the University of California at San Diego; San Diego State University; the California School of Professional Psychology at San Diego; and SSC San Diego.

Table 5 shows the distribution of participants according to the Hofstede culture clusters. Cluster 9 (virtually all U.S. participants) constituted 52.1% of the total number of participants. Cluster 4 (primarily Brazil, Greece, and Turkey) and cluster 5 (primarily Taiwan, Kenya, Thailand, and

Indonesia) constituted 20.7% and 16.2% of the participants, respectively. All remaining Hofstede culture clusters listed in table 5 together comprised less than 5% of the sample.

Table 5. Distribution of participants according to Hofstede culture clusters.

Culture Cluster	N	%	Detailed Composition of Sample
1	9	3.2	11.1% Puerto Rico, 77.7% Mexico, 11.1% Ecuador
2	4	1.4	100% Japan
3	2	0.7	100% France
4	58	20.7	22.4% Brazil, 22.4% Greece, 50% Turkey, 3.4% Argentina, 1.7% Egypt
5	45	16.2	15.5% Taiwan, 11.1% Kenya, 40% Thailand, 26.7% Indonesia, 2.2% Pakistan, 2.2% Laos, 2.2% Iran
6	8	2.9	12.5% Macedonia, 12.5% Yugoslavia, 12.5% Croatia, 12.5% Bulgaria, 12.5% Hungary, 25% Russia, 12.5% Peru
7	2	0.7	50% India, 50% Malaysia
8	2	0.7	100% Austria
9	146	52.1	97.9% USA, 0.7% England, 0.7% Canada, 0.7% Australia
10	2	0.7	100% Germany
11	2	0.7	100% Sweden

DECISION HEURISTICS QUESTIONNAIRE

Participants

One hundred ninety-two participants completed the decision heuristics survey questionnaire. Because a major aim of the CADM project was to extend the results of prior research on decision heuristics beyond Western student populations, the participant pool was drawn from culturally diverse sources. The Naval Postgraduate School (NPS) in Monterey, California, provided 88 junior military officers from the U.S. and several foreign countries, including Greece, Indonesia, Taiwan, Thailand, and Turkey. USIU in San Diego, California, supplied 104 civilian undergraduate and graduate students from several cultural backgrounds. The resulting participant diversity enabled comparisons to be made not only among cultural groups, but also between military and civilian groups. For comparison purposes, participants were grouped according to culture cluster when sufficient numbers (i.e., 30 or more participants per cluster) were present in the sample. Using this approach, three cultural clusters were formed:

- Cluster 4. Forty-two participants from Argentina, Brazil, Greece, Egypt, and Turkey.

18

- <u>Cluster 5</u>. Thirty-four participants from Indonesia, Iran, Kenya, Laos, Pakistan, Taiwan, and Thailand.

- <u>Cluster 9</u>. Thirty-nine participants from the U.S., plus one participant from Australia.

Decision Heuristics Vignettes

The questionnaire consisted of several decision-making vignettes designed to measure the following four decision heuristics.

Law of Small Numbers. Characteristics of small samples are deemed as representative of the much larger populations from which they are drawn. Consequently, too much weight is given to small sample results (which are more likely to be atypical than large sample results).

Framing Effect. Outcomes are evaluated as deviations from reference points or levels of aspirations. These reference points and levels of aspirations influence the manner in which people evaluate outcomes such that outcomes are framed as losses or gains. Framing can produce choice reversals in which the original decision is modified by the framing effect.

Base Rate Bias. Concrete information (i.e., information that is vivid and based on experience or isolated incidents) often dominates abstract information (base-rate statistics). Anecdotal reports from individuals are given greater credence than more valid statistical information based on studies involving many people.

Confirmation Bias. People seek information consistent with their own views/hypotheses and disregard information that could disconfirm those views/hypotheses.

These four heuristics are robust in Western populations in North America and Europe and exert strong influences on decision-making. Prior research has indicated that these heuristics exert important influences upon decision quality in real-world settings (e.g., Bohm and Lind, 1992; Frey, 1990; Tversky and Kahneman, 1971). However, there has not been much study on these heuristics with people from non-Western cultures. It was hypothesized that these heuristics constitute fundamental operations of the human cognitive system and, as such, would be observed in the culturally diverse sample. However, their form of expression may be moderated by culture-specific factors.

Organizational and Cultural Items

In addition to the four decision heuristics, the questionnaire contained several items that assessed the influence of organizational variables on decision-making and their relationships to the Hofstede and Chinese Culture Connection dimensions of culture.

Source Availability. Building upon research by O'Reilly and Roberts (1977), it was hypothesized that participants with low Masculinity scores would choose options linked to sources with reciprocal communication links.

Consensus. Building upon research by Merritt and Helmreich (1996), it was hypothesized that participants with low Power Distance scores would prefer consensus decision-making.

Vesting of Decision-Making Authority. Building upon research by Merritt and Helmreich (1996), it was hypothesized that participants with high Power Distance scores would prefer autocratic decision-making.

Peer/In-Group Pressure. Building upon research by Johnson (1974) and Triandis (1967), it was hypothesized that participants with high Collectivism scores would choose the option favored by or protective of peers/in-group members.

Role Specialization. Building upon research by Kasperson (1985), and Hesseling and Konnen (1969), it was hypothesized that participants with high Individualism scores would predict that (1) a group of specialists would be likely to make a superior decision while (2) a group of generalists would be likely to make an inferior decision.

Consultation. Based upon theorizing of Hofstede (1980), it was hypothesized that participants with high Collectivism scores would prefer consultation.

Policy Compliance. Based upon theorizing of Hofstede (1980), it was hypothesized that participants with high Uncertainty Avoidance scores would knowingly make an inferior decision rather than violate policy.

Utilitarianism versus Tradition. Based upon theorizing of the Chinese Culture Connection (1987), it was hypothesized that participants with long-term orientation would choose a utilitarian option, with emphasis on economy and value to a system versus an option that emphasized regard for tradition for its own sake.

EXPERIMENTAL STUDIES OF CULTURE AND DECISION-MAKING

The CADM project conducted three laboratory experiments. Two of these experiments investigated the influence of degraded information on decision-making while the third experiment considered cultural variations in situation assessment. These three experiments permitted inferences to be made about relationships among decision-making variables and cultural factors.

Participants

Participants in the three-laboratory experiment were recruited from several sources to obtain a culturally diverse sample. These sources included the student population at the Naval Postgraduate School in Monterey, California, San Diego State University, and USIU in San Diego. Participants were from several countries belonging to the following four Hofstede culture clusters: Cluster 4 (Brazil, Greece, and Turkey), Cluster 5 (Indonesia, Kenya, Taiwan, and Thailand), Cluster 7 (Malaysia, Philippines, and Singapore), and Cluster 9 (U.S.). Military and civilian students were sampled, permitting comparisons among these groups.

Participants in the first experiment (information loss):

- Cluster 4. Twenty participants from Brazil, Greece, and Turkey.

- Cluster 5. Eleven participants from Indonesia, Taiwan, and Thailand.

- Cluster 9. Nineteen participants from the U.S.

Participants in the second experiment (information quality):

- Cluster 9. Thirty-eight participants from the U.S.

Participants in the third experiment (source credibility and rank status):

- Cluster 4. Fourteen participants from Greece and Turkey.

- Cluster 7. Thirteen participants from Malaysia, Philippines, and Singapore.

- <u>Cluster 9</u>. Thirteen participants from the U.S.

Scenario Description

For all three experiments, a computer-based "micro-world" simulation described variations of a water rights conflict in a hypothetical geopolitical region. The simulation was developed by a subject matter expert familiar with military decision-making in situations involving incomplete, uncertain, and ambiguous information. The scenario described a situation in which several neighboring countries had unequal access to limited water supplies. The possibility was raised that one of the countries might stage border incursions over disputed territory containing water resources. These countries differed in terms of military capabilities, social and political circumstances, geographic features, and natural resources, among other factors.

The scenario permitted the possibility of two mutually exclusive events: war games in one of the countries or an attack by that country on another country. At the outset of each experiment, each participant received instructions that either favored one event over other events or that were neutral with regard to event likelihoods. Participants were told that they were to monitor incoming message traffic and provide periodic situation assessments regarding the likelihood of an attack by one country on another country. Figure 3 shows an example of the display as viewed by the participant. A map occupying the upper part of the screen showed the countries of interest, military units of other countries, major transportation elements (railroad tracks, airports, bridges), geographic features (rivers, lakes, drainage areas), and country boundaries and names. A legend for the map symbols was located to the right of the map. Several items were displayed below the map including each new message, its source, when it was sent, and the elapsed time since the prior message.

Procedure

A set of 100 messages, organized into 10 blocks of 10 messages each, was presented to each participant. Based on these messages, participants estimated the likelihood of an attack by one country on another country in that region. Messages were presented singly and participants moved through each block of messages at their own pace. Upon completing each block, a screen (figure 4) was displayed. Participants entered a likelihood estimate for attack using a seven-point scale that ranged from "Very Low" to "Very High." A confidence rating was also made for each likelihood estimate using a 10-point scale. At the end of each block of messages, participants revised their likelihood estimates and confidence ratings.

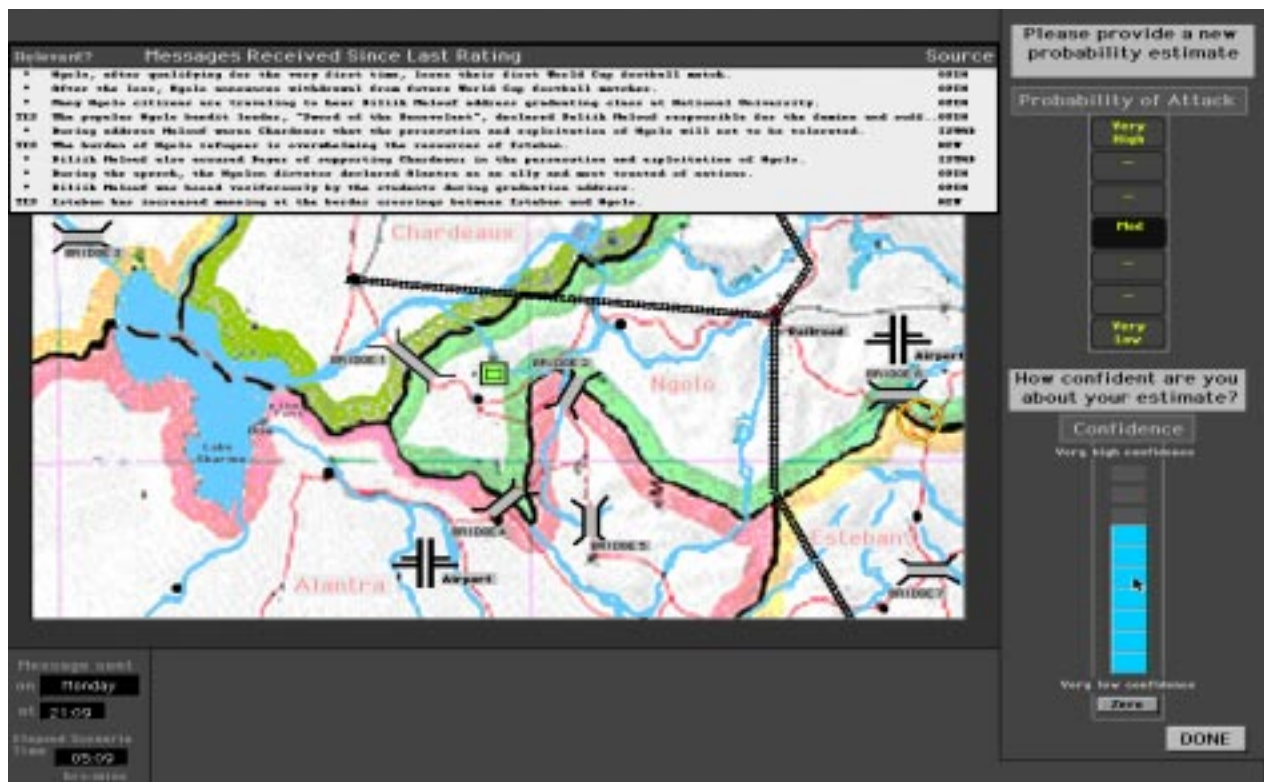Figure 3. Sample screen showing information display and response interface.

Figure 4. Sample screen during block assessment period.

In the first two experiments, two types of information degradation were examined: information loss and information quality. The information loss experiment withheld either 5 or 50% of the messages in each half of the experiment. The information quality experiment manipulated message quality by stating that receipt of each message as sent was either verified or unverified. Either 5 or 50% of the messages in each half of the experiment were unverified. In both, participants rated each message according to the extent it supported the occurrence of three non-mutually exclusive events in one of the countries in that region: war games, coup d'état, or attack on another country.

In the third experiment, which focused on the effects of source credibility and rank status, participants received instructions at the outset that either (1) favored an attack by one country on another country in that region, (2) favored the occurrence of wargames in that country or (3) that were neutral with regard to the likelihood of attack and war games. Each of the 100 messages originated from one of three sources that differed in credibility. After reviewing each block of messages, participants estimated the likelihood of attack and rated their confidence in that estimate. To examine effects of rank status, simulated e-mail messages were interjected into the message stream at periodic intervals. These messages requested participants to assess a situation that was not directly related to the primary task. Feedback provided from superior and subordinate sources either agreed or disagreed with the participant's original assessment, which could then be changed if the participant so desired.

MAJOR FINDINGS

This section reports the major findings from the three experiments and one survey questionnaire conducted during the CADM project. These studies examined three principal issues pertaining to cultural differences in decision-making. The first issue concerned the influence of degraded information on decision-making. Two types of information degradation were investigated, the quality and amount of available information. The second issue addressed cultural variations in decision heuristics. Research in cognitive psychology has established that people often use decision heuristics to simplify the information processing demands brought on by complex and ambiguous situations. However, this research has largely failed to investigate any cross-cultural variations that might exist in the use of decision heuristics. The third issue concerned cultural variation in situation assessment when source credibility, rank status of information sources, and organizational variables are varied. Fundamental to each issue is categorizing each participant into the most appropriate cultural group given their background, values, and preferences. Therefore, we first turn to the enculturation findings based on the survey questionnaire.

ENCULTURATION AND CULTURAL DIMENSIONS

Recall that enculturation in this project was defined as the degree to which an individual is typical of a given cultural group. Enculturation was calculated by combining six component factors to yield a summary measure called the enculturation index. Analysis of responses to the Enculturation Index indicated that this multi-component method of measurement and categorization is more accurate and reliable than any single marker component such as language. An enculturation index was generated for each participant in the questionnaire study. The index was used to assign each participant to one Hofstede culture cluster.

Of the 280 people who completed the cultural questionnaire, seven (2.5%) were reassigned to a country other than the one they listed as their home country on the questionnaire. Reassignment most frequently occurred when the respondent listed a home country that did not match his citizenship, when the percentage of life lived in the listed home country was very low, and when the respondent's primary and secondary education took place outside the listed home country. Inspection of the responses of those who were reassigned revealed two patterns: (1) respondents who listed the U.S. (where they were currently studying) as their home country, though they were only in the U.S. for university study, and (2) respondents who listed as their home country the land of their ancestral family before migration. Additional instructions could be provided regarding the definition of *home country* to avoid similar misunderstandings in future studies.

Dimensions by Country Clusters

Hofstede recommends that group-level scores are not valid with less than 50 respondents per group (Birnbaum–More, personal communication, 3/17/98). Only culture clusters 4, 5, and 9 came close to meeting these criteria in this study, so group-level scores are only reported for those clusters.

- Cluster 4 (58 respondents). Most of the sample (95%) consisted of people from Brazil, Greece, and Turkey; Argentina and Egypt were represented by only three people.

- Cluster 5 (45 respondents). The majority of the sample (82%) was from Indonesia, Taiwan, and Thailand. An additional 10% of the sample was from Kenya. Iran, Laos, and Pakistan were each represented by only one person.

- Cluster 9 (146 respondents). With the exception of three respondents (one each from England, Australia, and Canada) all respondents in cluster 9 were assigned the U.S. as their home country.

As explained above, Hofstede (1980, 1983) described the profiles that resulted from the cluster analysis in terms of positioning of dimension scores into *low, medium,* and *high* categories. Confucian Work Dynamism scores from the Chinese Culture Connection (1987) were also categorized as *low, medium,* or *high*. Of interest are comparisons of the positions of the cluster scores from the present study with the original profiles. Table 6 shows the comparisons resulting after the cluster scores from the current study are categorized and compared with values from the original studies. A satisfactory level of comparability was found.

Dimensions by Military Status

Another factor that contributes to decision-making is the *organizational culture* in which a decision is made. Organizations that have comparable missions (military organizations) have established structures (rank hierarchies) that may be less variable across cultures than different types of organizations within a given culture. For example, certain decision-making "styles" might be more prevalent in military organizations than in any culture-at-large. To investigate this possibility, the cultural questionnaire data were analyzed in terms of military status (Military: 147 respondents; Civilian: 133 respondents).

Table 7 shows the culture dimension scores according to military and civilian status. The largest difference between military and civilian scores was observed for Uncertainty Avoidance—the civilian group is very low and the military group is high. This result is consistent with the concept of Uncertainty Avoidance in that members of the military group would highly value a structured environment and a way of life associated with maintenance of peace and order in the larger, societal culture. There is also a sizable difference between military and civilian scores on the Power Distance dimension—the civilian group is high and the military group is medium. This difference seems counter to expectations in that high Power Distance is associated with the acceptance of inequalities in a culture and the military is an inherently hierarchical organization. However, the demographics of the study sample provides an explanation. All military samples were officers of ranks that are at the management-level of their organization and mostthe civilians were students who might be considered relatively lower status in their organization (college/university). Hofstede (1980) reported occupational differences such that higher Power Distance scores tended to be associated with lower status occupations.

Table 6. Comparisons of dimension levels from study sample, Hofstede (1980, 1983) and the Chinese Culture Connection (1987).

	Cluster 4	Cluster 5	Cluster 9
Power Distance: Observed levels	*mid*	*high*	*mid*
Hofstede levels	*high*	*high*	*low*
Uncertainty Avoidance: Observed levels	*high*	*low*	*low*
Hofstede levels	*high*	*mid*	*low*
Individualism-Collectivism: Observed levels	*low* I	*low* I	*high* I
Hofstede levels	*mid* I	*low* I	*high* I
Masculinity-Femininity: Observed levels	*low* M	*mid* M	*low* M
Hofstede levels	*mid* M	*mid* M	*high* M
Confucian Work Dynamism: Observed levels	*mid*	*mid*	*mid*
CCC levels	*high*	*high*	*low*

Table 7. Comparisons of dimension scores by military status grouping.

	Military	Civilian
Power Distance: Observed	58	88
Uncertainty Avoidance: Observed	83	-1
Confucian Work Dynamism: Observed	54	38
Individualism-Collectivism: Observed	33	49
Masculinity-Femininity: Observed	31	41

DECISION HEURISTICS IN CROSS-CULTURAL PERSPECTIVE

This section discusses the findings of a questionnaire study that investigated four decision heuristics and the effect of eight organizational and cultural variables on decision choices. These findings replicated and extended the results of prior decision heuristic research by providing information about decision performance across cultural groups and North Americans and Western Europeans, and including military and civilian personnel.

Decision Heuristics

This study investigated decision biases associated with the law of small numbers, framing effect, base rate bias, and confirmatory bias.

Law of Small Numbers. This study replicated effects previously reported with the law of small numbers—too much weight was given to small sample results. Two items measured this heuristic. On one item, the military group gave the correct response significantly more often than the civilian group. On the second item, culture cluster 5 gave the correct response significantly more often than culture clusters 4 and 9. That is, cluster 5 and the military group showed less susceptibility to the law of small numbers bias.

Framing Effect. As figure 5 shows, in every group (clusters 4, 5, 9, civilian, and military), more respondents were risk-seeking at the negatively framed item (the loss frame) than at the positively framed item (the gain frame). This result replicates established findings on the framing effect. Differences between groups were statistically significant in the total sample, in the civilian group, and in culture cluster 5. These groups showed a greater susceptibility to the framing effect. Cultures higher in Uncertainty Avoidance, such as cluster 4 countries, would probably be less susceptible to the framing effect because they would be expected to choose the risk averse option with greater frequency, regardless of frame. That is, there would be less differentiation of choice between the negatively

framed item and the positively framed item. This lack of differentiation was observed in the two higher Uncertainty Avoidance groups (i.e., the military and cluster 4) while two of the three lower Uncertainty Avoidance groups (i.e., civilians and cluster 5) showed higher differentiation between frames. Only in cluster 9, a group with lower Uncertainty Avoidance where there was a low degree of differentiation between frames, did observations not match this expected pattern.
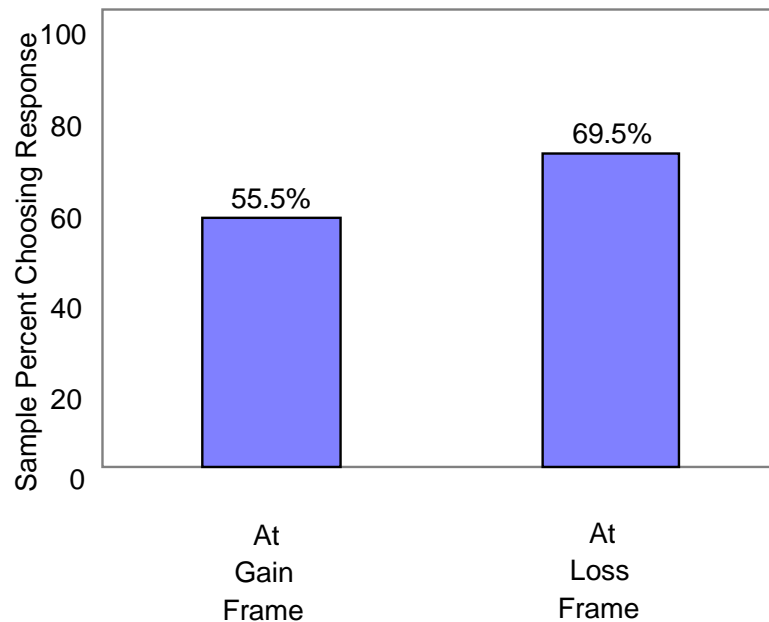

Figure 5. Framing effect observed.

Base Rate Bias. The most common, but incorrect, response was to overvalue concrete information. This result replicates established research findings. There were no significant differences between military and civilian groups or among the three culture clusters—all displayed the base rate bias to a similar degree. Valid abstract base rate information tends to be ignored or underutilized when situation-specific information is available.

Confirmation Bias. Figure 6 shows that confirmation bias predominated in all groups. The response that could only confirm, but could not disconfirm, was the most preferred response. This result replicates prior research findings on confirmation bias. Cluster 5 was significantly less prone to confirmation bias than clusters 4 and 9, which did not differ from each other. This result is counter to expectations that a high Power Distance culture, with high authoritarianism and centralization of decision-making, would be more susceptible to confirmation bias (Hofstede, 1980; Hutchins, 1991). There were no differences between the military and civilian groups.
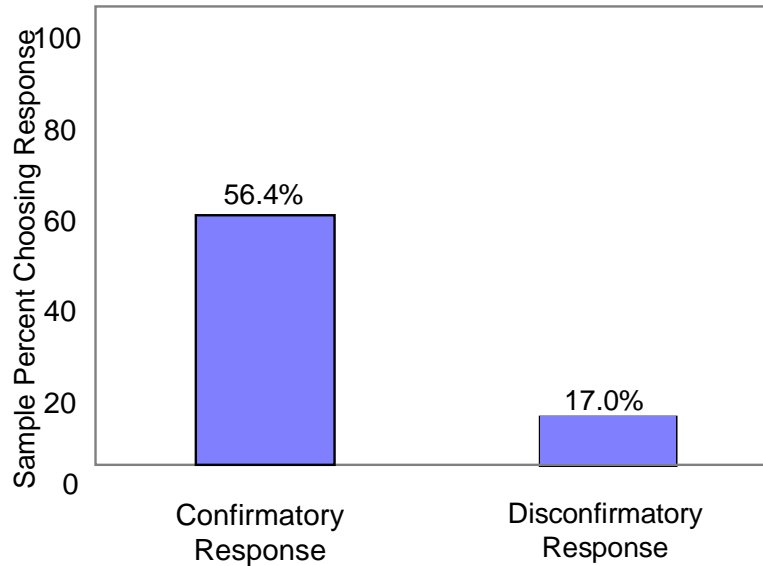
Figure 6. Confirmation bias observed.

In summary, decision heuristics observed in Western populations were found in the other cultural groups in this study. This finding suggests that decision heuristics may indeed be core components of human cognitive processes. Significant differences between cultural and military groups were found for the law of small numbers, where the military group and culture cluster 5 were less subject to the bias, and for confirmation bias, where culture cluster 5 was again less subject to the bias. In the civilian group and culture cluster 5, the framing effect was larger than in the other groups. For more detailed results, see Heacox, Gwynne, and Sander (1998).

Organizational and Cultural Factors

This study investigated several organizational and cultural factors that might influence decision-making.

On the following items, the hypothesized relationships between research variable and cultural dimension were not found, thereby precluding inferences.:

Source Availability. All groups (by approximately 2:1 within each group) would change an initial inferior decision if they could contact the source of the updated information that caused them to question their initial decision. In contrast, when the source of the information update could not be contacted, all groups would retain the initial inferior decision, by approximately 2:1.

Consensus. In all groups, obtaining consensus of all involved individuals was preferred over decision-making by a limited number of individuals. There were no significant differences among the cultural groups or the military and civilian groups.

Peer/In-Group Pressure. By approximately 4:1, all groups indicated they would resist peer pressure and implement the more efficient plan.

Role Specialization. Most groups predicted that a good decision could be made by a decision-making group composed of either specialists or generalists. Cluster 5 predicted that a specialist decision-making body could make a good decision significantly less frequently than clusters 4 and 9.

Utilitarianism verus Tradition. All groups were nearly evenly divided in their preferences for a utilitarian option, with emphasis on value to a system, or an option that emphasized regard for tradition for its own sake. There were no significant differences between cultural or military versus civilian groups.

On the following items, relationships between research variable and cultural dimension were found; however, many observations were not as hypothesized.

Vesting of Decision-Making Authority. By approximately 9:1, all groups preferred to involve staff in decision-making. There were no significant between-group differences. Only in cluster 4 was the hypothesized relationship found that high Power Distance would be associated with autocratic decision-making.

Policy Compliance. Most groups chose to implement a superior plan even if it violated current policy. Significant differences between groups were found only between the military and civilian groups—the military group more frequently chose to make a superior decision at the expense of policy than did the civilian group. A significant relationship was found overall between the Uncertainty Avoidance dimension, which was high in the military group and low in the civilian group, and decision choice. However, contrary to expectations, participants who scored high in Uncertainty Avoidance chose to make a superior decision at the expense of policy. Specific task demands may interact with organizational and cultural dimensions to influence decision-making behavior. In this survey problem, adherence to policy was associated with a poor outcome (adoption of an inferior choice). Prior research by Lipshitz (1989) in military units has shown that judgment by outcomes rather than process is a pervasive heuristic. Regardless of the process used to arrive at a decision, including adherence to organizational policy, the decision-maker was judged by the success or failure of the result.

Consultation. There was an overall preference for consultation before making a decision, but preferences within groups were mixed. The military group was evenly divided between obtaining consultation and making a decision independently. The civilian group showed a slight preference for consultation. In culture clusters 4 and 5, there was a small preference for making the decision on one's own, whereas a strong preference for consultation was seen in cluster 9. This difference between culture clusters was statistically significant. A significant relationship between Individualism–Collectivism and decision choice was found overall in cluster 9 and in the civilian group. However, contrary to expectations, participants with low Collectivism scores preferred consultation. High Individualism may be associated with individual responsibility for decision–making, even in a highly sensitive situation involving a member of an in-group. By contrast, high Collectivism is theorized (Hofstede, 1980) as associated with a designated decision-maker, an authority figure within each in-group that makes decisions on his own for the good of the group. In sensitive situations, consultation might be viewed as inappropriate.

In summary, cultural groups were similar to each other on most organizational and cultural items. Differences were observed, however, in the areas of preference for consultation, effects of organizational policy, and effects of role specialization. Most linkages predicted were not found among cultural and organizational variables and decision preferences. A possible explanation for these findings is an interaction between task demands and culture dimensions. Part of the "problem" may lie with the items used to measure the culture dimensions. Statistical constraints (e.g., limited number of items defining the Power Distance and Uncertainty Avoidance indexes; a restricted range of responses on the

Individualism–Collectivism and Masculinity–Femininity indexes) might place a limit on the predictive power of the dimensions. It might also be advisable to develop items that capture the culture dimensions in domain or task-specific environments as other researchers (e.g., Ali, 1993; Merritt and Helmreich, 1996) have done. These items can then be used to enhance the original items used. The combined use of global and specific items could be highly valuable in developing predictive concepts in specific decision task settings.

EFFECTS OF DEGRADED INFORMATION ON DECISION-MAKING

This section presents the findings of the first two laboratory experiments in the CADM project. These experiments investigated the effects of culture on decision-making under two conditions of information degradation: information loss and information quality. Findings from these experiments extended our understanding of how people with different cultural backgrounds respond to decision situations involving degraded information. Decision processes that might be moderated by cultural factors include situation assessment, the collection and integration of information, and modifying decisions based on subsequent evidence.

In overview, participants in all cultural groups identified the most likely outcome (coup) sooner when only 5% of the messages were disrupted than when 50% were disrupted. However, cultural groups differed in terms of event likelihoods and confidence ratings in those estimates. These differences were influenced by the type (quality or loss) and amount (5% or 50%) of information disruption, indicating that those cultural factors interacted with task information characteristics. Several cultural dimensions used to describe the groups implicated tolerance for uncertainty, authority relationships, and the degree of individualism present in a culture as factors contributing to these differences. Direct comparison of the information loss and information quality experiments indicated that access to information did not need to be restricted to influence decisions; compromising the quality of information also influenced decisions and the confidence placed in them.

Information Loss

Cultural Variations in Likelihood Estimates. Figure 7 shows the probability estimates for the coup outcome according to each culture cluster for all block assessments. The three culture clusters differed significantly, with cluster 4 exhibiting significantly higher coup probability estimates than cluster 5, but not from cluster 9. As expected, probability estimates increased as the experiment progressed. Although there were no statistically significant differences in the pattern of change for the different culture clusters, clusters 5 and 9 showed a similar pattern of gradual increases while cluster 4 started at a higher level and did not increase as much.

Differentiating Decision Alternatives. When confronted with several alternative events in an ambiguous decision-making situation, people vary in the speed with which they differentiate among those events. An analysis investigated the possibility that cultural variables influence differentiation among decision alternatives. Figure 8 shows the amount of differentiatiation among the three event outcomes (coup, war games, and attack) at the end of the first half and the second half of the experi-ment for each culture cluster. An analysis of variance was conducted on the difference between the maximum and the minimum event probability estimates for each culture cluster at the end of both halves of the experiment. A highly significant increase in this difference was found, indicating that the three events became increasingly differentiated as the experiment progressed. Participants became better able to make independent probability estimates for each of the three event outcomes as they gained more knowledge about the scenario. Furthermore, this ability to differentiate varied across culture cluster.
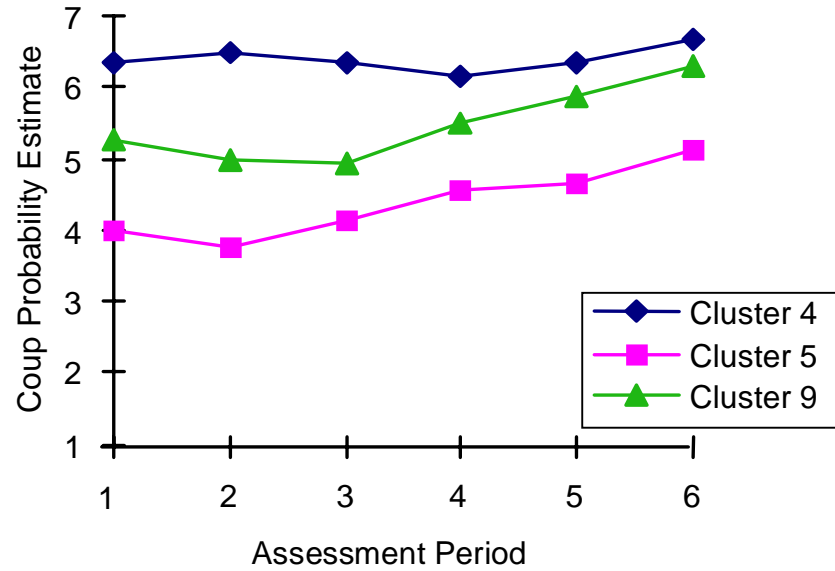
Figure 7. Coup probability estimates by cultural cluster in information loss experiment.
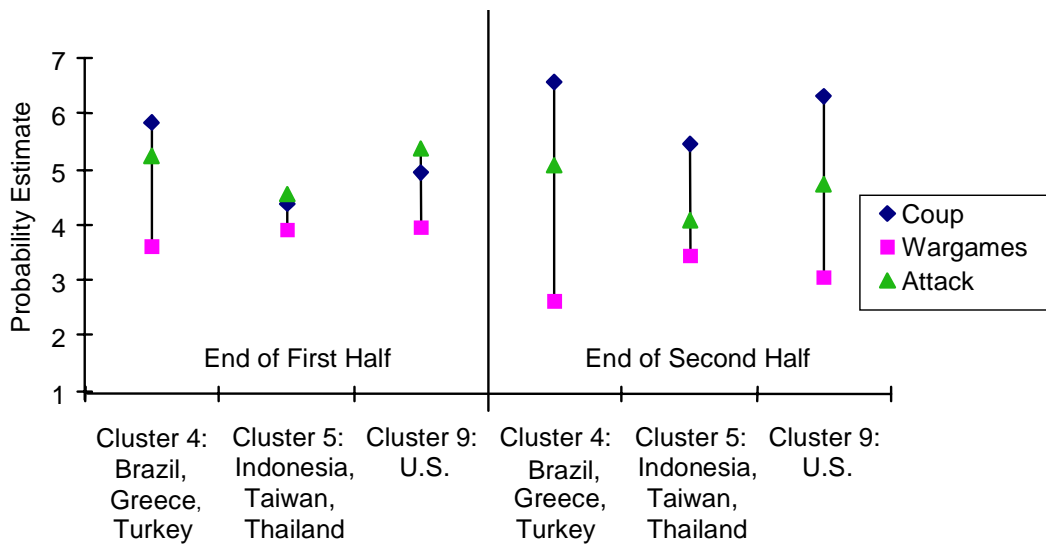

Figure 8. Differentiation among event outcomes according to culture clusters in information loss experiment.

A significant main effect was obtained for culture group. A post-hoc means comparison (Scheffé) determined that cluster 4 was significantly more differentiated than cluster 5, but not cluster 9, and that clusters 5 and 9 were not different from each other. At the end of the first half, cluster 4 had the greatest differentiation for the three event outcomes. Coup and attack were clearly separated from war games and, to a lesser extent, from each other. In contrast, participants in cluster 5 had not formed any meaningful differentiations of the event outcomes. Cluster 9 differentiated the events more so than cluster 5, but not as much as cluster 4. At the end of the experiment, all three clusters showed greater differentiation than at the end of the first half. Cluster 4 again had the greatest differentiation, followed by cluster 9, and then cluster 5. Each cluster estimated coup as the most probable event, followed by attack, and then, war games. Participants in cluster 5 did not differentiate among war games and attack as much as participants in clusters 4 and 9, although they showed a similar differentiation between coup and attack. The greater differentiation among events by cluster 4 might be related to the association of cluster 4 with greater Uncertainty Avoidance than clusters 5 and 9. This association suggests that cluster 4 has a lower tolerance for uncertain and ambiguous situations, which results in a clearer separation of decision alternatives. Thus, the greater event differentiation by cluster 4 might be because of a desire to reduce decision uncertainty.

Cultural Variations in Confidence Ratings. People from different cultural backgrounds might not be equally sensitive to the amount of information made available for decision-making. Figure 9 shows that the confidence ratings of cluster 4 (Brazil, Greece, Turkey) and cluster 9 (U.S.) did not change as the amount of information disruption changed. In contrast, cluster 5 participants (Indonesia, Taiwan, Thailand) became more confident as more information was available. Although this difference was not statistically significant, it suggests that cluster 5 is more sensitive to information quantity than clusters 4 and 9. Accordingly, cluster 5 might be less vulnerable than clusters 4 and 9 to conditions that either increase or decrease the amount of information available for decision-making.
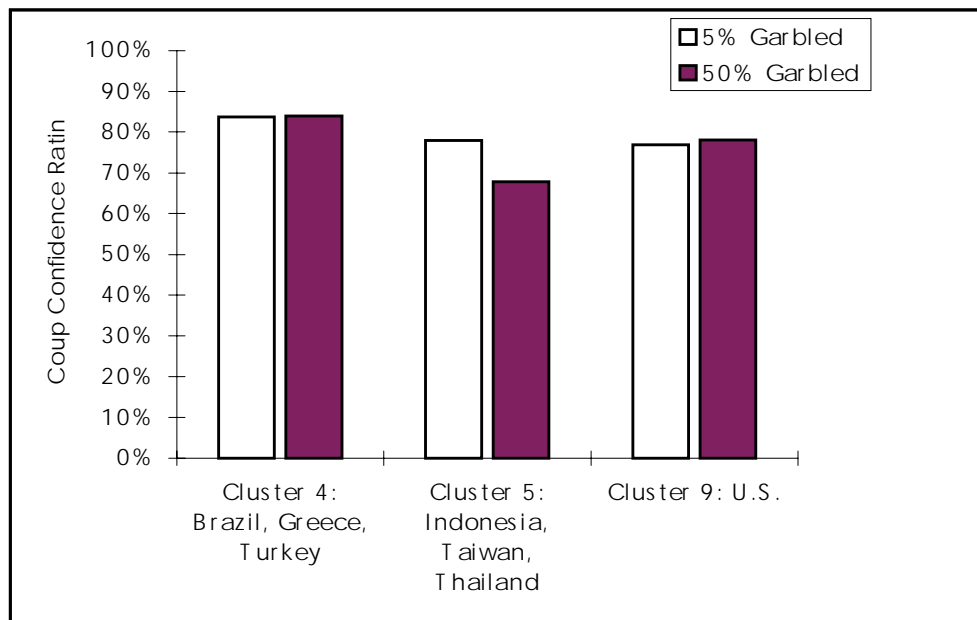

Figure 9. Coup confidence ratings by cultural cluster in information loss experiment.

Information Quality

The information quality experiment directly compared the decision-making performance of U.S. military and civilian participants. Although this study did not compare cultural groups in the usual sense, the comparison of military and civilian participants constituted a cultural comparison of sorts. Because the military is a highly specialized organization with numerous attributes that distinguish it from the general civilian population, it possesses its own distinct culture.

Group Variations in Likelihood Estimates. Figure 10 shows the probability estimates for the coup outcome for military and civilian participants across all block assessments. Both military and civilian groups displayed a similar pattern of gradual, but consistent and significant increases in the estimated probability of coup as the experiment progressed. The pattern of change in the probability estimates was different for the two groups. The military participants estimated a coup as less likely than did the civilian participants for all assessment periods except for the last one when they assigned coup its highest probability.
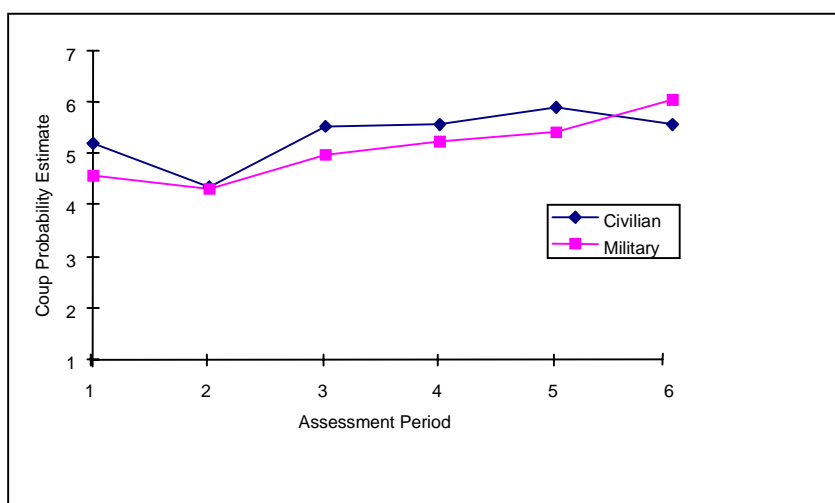

Figure 10. Coup probability estimates in information quality experiment.

Differentiating Decision Alternatives. Figure 11 shows the amount of differentiation that had occurred at the end of both halves of the experiment. There were significant differences in the degree to which participants increasingly differentiated the three events as the experiment progressed. There were no significant differences between the maximum and the minimum estimates for the three event outcomes for the military and civilian groups. However, it is still informative to describe variations in their patterns of event differentiation. At the end of the first half, neither military or civilian participants had differentiated coup from attack, although both events were clearly distinct from war games. By the end of the experiment, the military group had differentiated coup from attack to a greater extent than the civilian group. The command and control scenario was likely more familiar to military personnel than to civilians. Also, the greater differentiation by military participants is consistent with them being higher in uncertainty avoidance than the civilian participants. Greater differentiation among event outcomes implies that the military participants had eliminated more of the scenario uncertainty before reaching a decision than had their civilian counterparts.
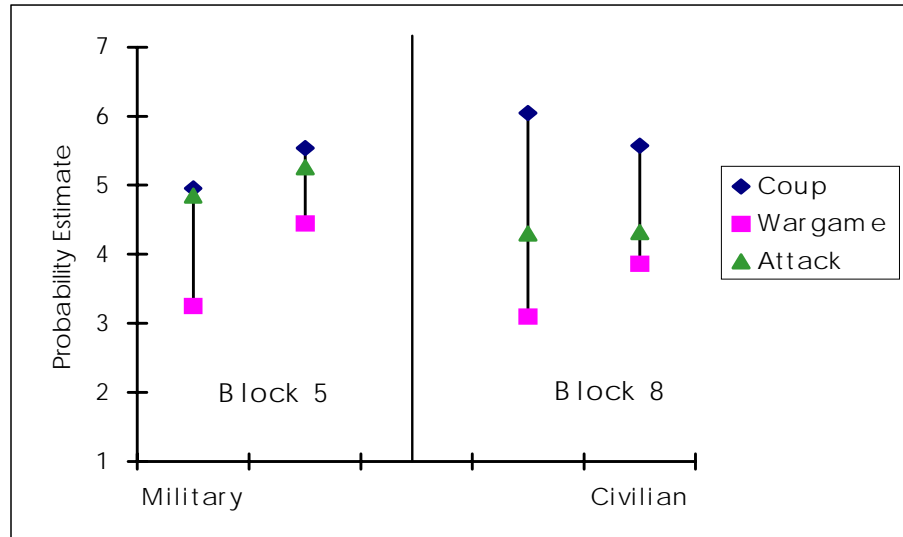
Figure 11. Differentiation among event outcomes by military and civilian groups in information quality experiment.

Group Variations in Confidence Ratings. As figure 12 shows, military participants were significantly less confident of their coup probability estimates than civilian participants. There were no significant differences between the two information disruption conditions within each group. This result pattern is similar to that observed for the U.S. participants in the information loss experiment. Participants became more confident in their coup likelihood estimates as they gained experience with the scenario; confidence ratings increased in the second half of the experiment regardless of whether they were experiencing the 5% or 50% information degradation condition.
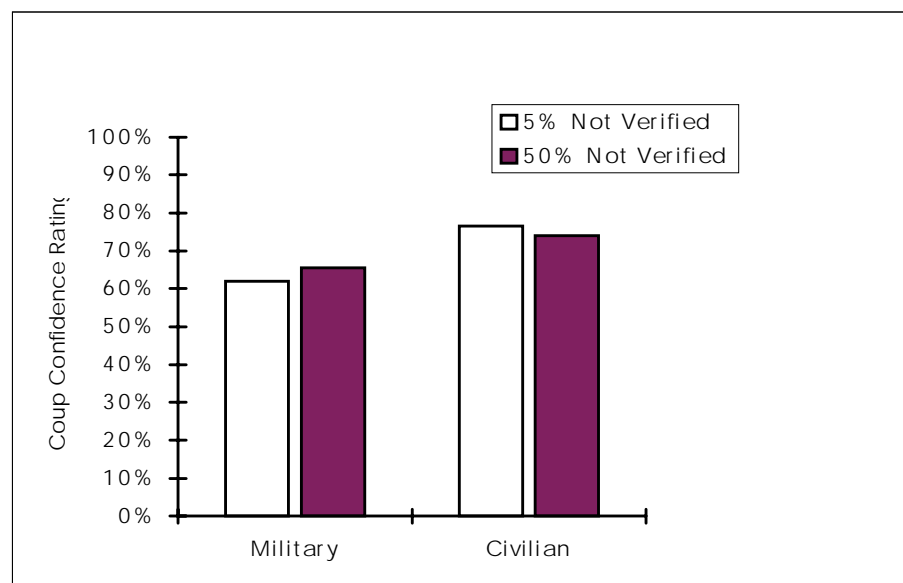

Figure 12. Coup confidence ratings in information quality experiment.

It is interesting to consider these results in terms of the response differentiation findings. The military participants formed more clearly defined differentiations among the event outcomes than did the civilian participants. However, the military participants were less confident in their judgments. Perhaps military personnel are trained to be decisive when confronted with uncertainty whereas civilians typically form weaker opinions, but are more confident in them.

Information Quality versus Information Loss

Differences in decision-making based on compromised versus missing information were compared across the information quality and information loss experiments, respectively. This comparison was restricted to cluster 9 participants because the information quality experiment used only participants from the U.S. Figure 13 shows that although there was a significant increase in coup probability estimates across assessment periods, once a story line was established, there were no meaningful differences in coup probability estimates between the two types of information disruptions. This finding suggests that it is not necessary to deny information to influence decisions; information compromise is just as effective a strategy.
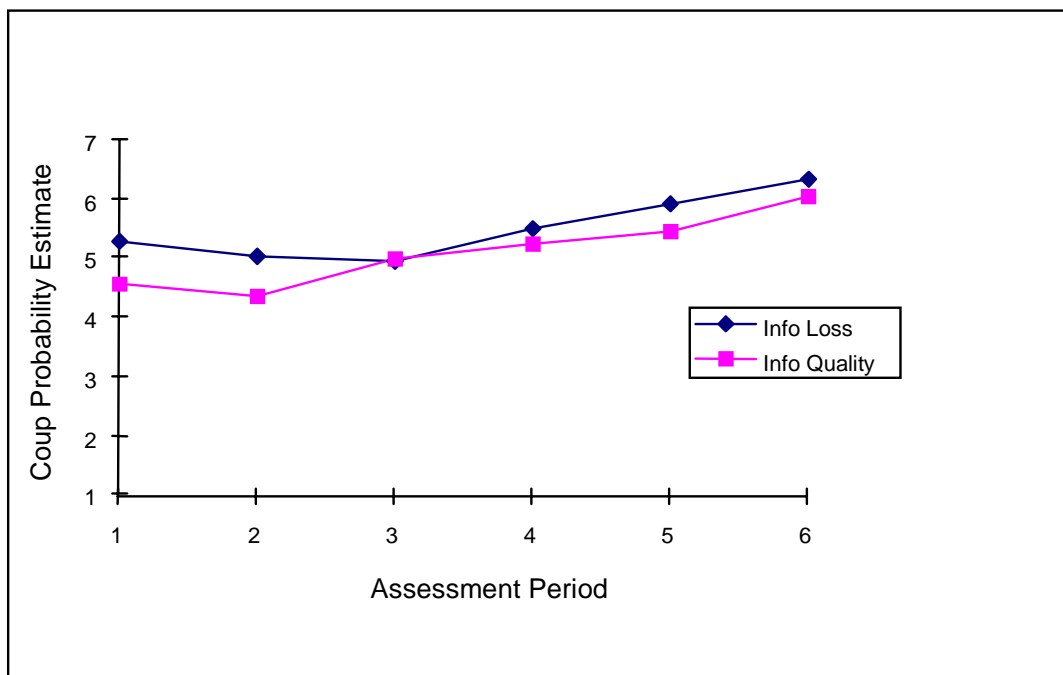

Figure 13. Coup probability estimates by cluster 9 participants across information quality and information loss experiments.

Next, the confidence placed in those probability estimates was evaluated across the information quality and information loss experiments. Greater confidence in a decision might make a decision-maker less likely to modify or abandon that decision. The level of confidence in a decision might depend upon the amount of information available for making that decision. To examine these possibilities, coup confidence ratings were compared. Figure 14 shows that compromised information (information quality experiment) was associated with significantly lower confidence ratings than was missing information (information loss experiment). Evidently, interpreting compromised information

placed an extra burden on the decision-maker compared to not having as much information. Also, within each experiment, the disruption condition (5 versus 50%) had no effect on the confidence in a decision. This result might be related to the law of small numbers bias that states that people often fail to consider the size of the sample upon which they base their judgments. In addition, participants became more confident in their coup likelihood estimates as they gained experience with the scenario regardless of the type of information disruption. For more detailed results, see Gwynne, Heacox, Sander, and Fleming (1998).
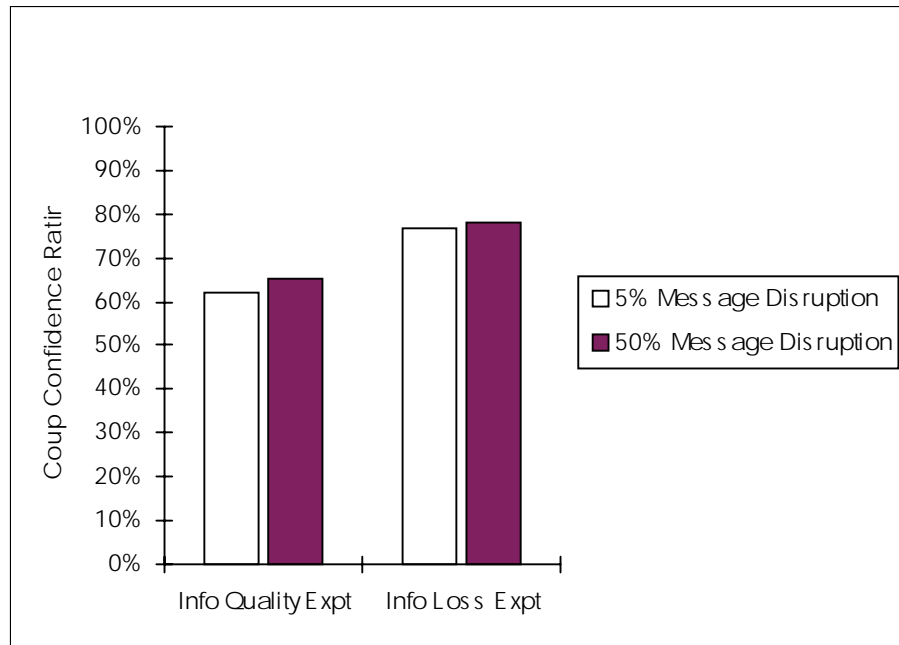

Figure 14. Coup confidence ratings by cluster 9 participants across information quality and information loss experiments.

CULTURAL VARIATIONS IN SITUATION ASSESSMENT

This section presents findings from the third experiment, which investigated the effects of culture, message information content, rank status, and source credibility on decision-making. This experiment focused more on organizational factors and their interaction with decision variables and cultural factors than did the first two experiments that focused more on information variables. Two Hofstede cultural dimensions, Power Distance and Uncertainty Avoidance, were assessed to informational and organizational variables.

In overview, similar to the previous two experiments, all cultural groups increased their event likelihood estimates as more messages about the developing situation were reviewed. However, the groups differed significantly in the rates at which their estimates increased. Participants from Malaysia, the Philippines, and Singapore initially made lower estimates, but then increased to a level comparable with the other participants as the study progressed. Participants were most influenced by the messages they received in the first half of the experiment, regardless of whether or not those messages came from a high- or low-credibility source. Participants had a strong tendency to assess the situation as soon as possible after encountering it, regardless of the quality of information used to make those assessments.

The rank status manipulation found that across cultural groups, the most common strategy was to change the initial assessment only when both superior and subordinate dissented.

Cultural Variations in Likelihood Estimates

Figure 15 shows the attack likelihood estimates for each culture cluster for all block assessments. The two-way interaction of culture by assessment period was significant. All three cultural groups increased their estimate of the likelihood of attack as they were provided with more information about the developing situation. However, the groups differed in their rates of increase over time. The initial assessment (block 1) of clusters 4 and 9 was the same and cluster 7 was more conservative (lower likelihood), but by the final assessment (block 11), clusters 4 and 9 had the most disparate values, with cluster 7 in the middle. The relative positions of the clusters changed several times over the 11 assessment blocks.
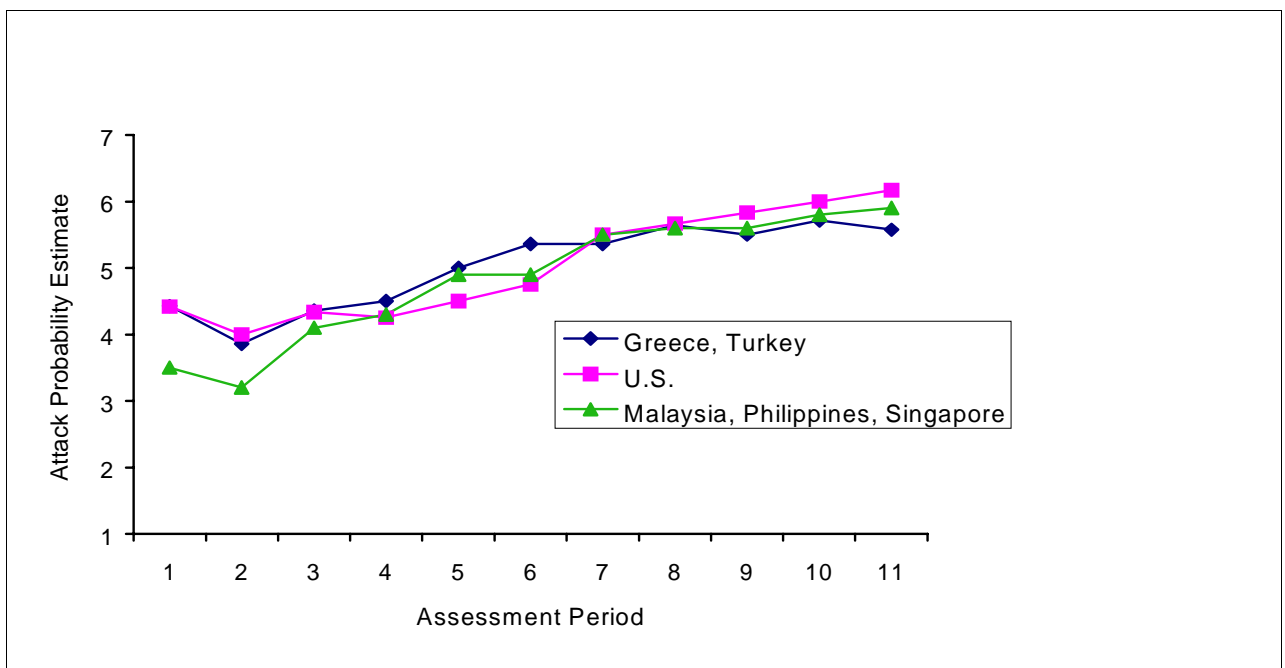

Figure 15. Attack likelihood estimates by culture cluster.

Cultural Variations in Confidence

Figure 16 shows how the confidence ratings of each culture cluster varied as the experiment progressed. As with the likelihood ratings, there was evidence for a culture by assessment period interaction, although after adjusting for a violation of sphericity, it just failed to attain significance. Culture cluster 7 (Malaysia, the Philippines, and Singapore) differed from the other two clusters, starting lower and following a less-consistent pattern as the study progressed. However, all three clusters tended to become more confident in their likelihood estimates as they gained more information.
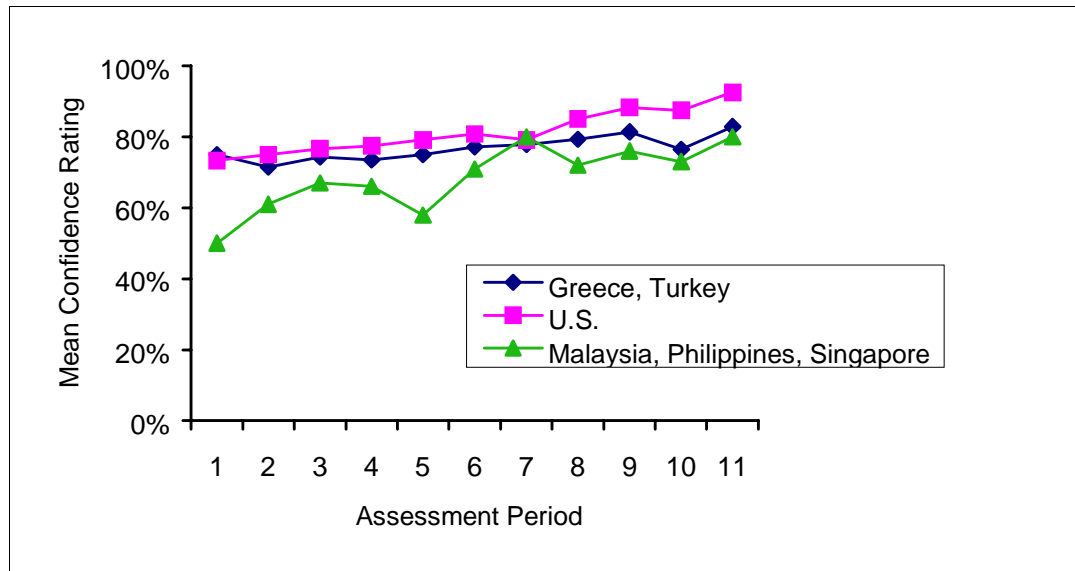
Figure 16. Confidence ratings by culture cluster.

The finding that confidence increased over time is not surprising. As more information is obtained, the amount of uncertainty in the situation often decreases. The cultural patterns, however, were not as expected. Recall that there were differences between the cultural clusters that, while not statistically significant, still merit consideration. Figure 16 shows that the differences were largely because the Asian cluster 7 provided lower confidence ratings than the other two clusters. Previous research (Wright and Phillips, 1980; Yates and Lee, 1996) found that most Asian cultures show a higher level of confidence, a finding that is usually attributed to the de-emphasis in Asian cultures on critical analysis of decision problems. The present findings might be because factors such as (1) the English language might have presented greater challenges to this group of participants, resulting in lowered confidence, or (2) the design of this study might have forced analysis of a problem situation in a manner that is less familiar to this group of participants, resulting in lowered confidence.

Source Credibility

Source credibility was examined by varying the type of source that delivered critical messages. In one condition, critical messages favoring an attack interpretation (pro-attack) were presented by a higher credibility source in the first half of the experiment and by a lower credibility source in the second half. In the other condition, the order was reversed. The source credibility manipulation enabled any differential influence of a higher versus a lower credibility source on likelihood estimates for attack to be examined. It was hypothesized that source credibility would interact with the assessment periods such that attack messages from higher credibility sources would encourage higher likelihood estimates than attack messages from lower credibility sources.

Figure 17 shows a significant interaction of source credibility by block for the likelihood estimate for attack. Likelihood estimates increased in both halves, but more so during the first half (when a high-credibility source provided critical messages) than in the second half (when a low- credibility source provided critical messages). Note, however, that the likelihood estimates in the second half were higher than those in the first half, indicating that a low-credibility source did not erode judgments.
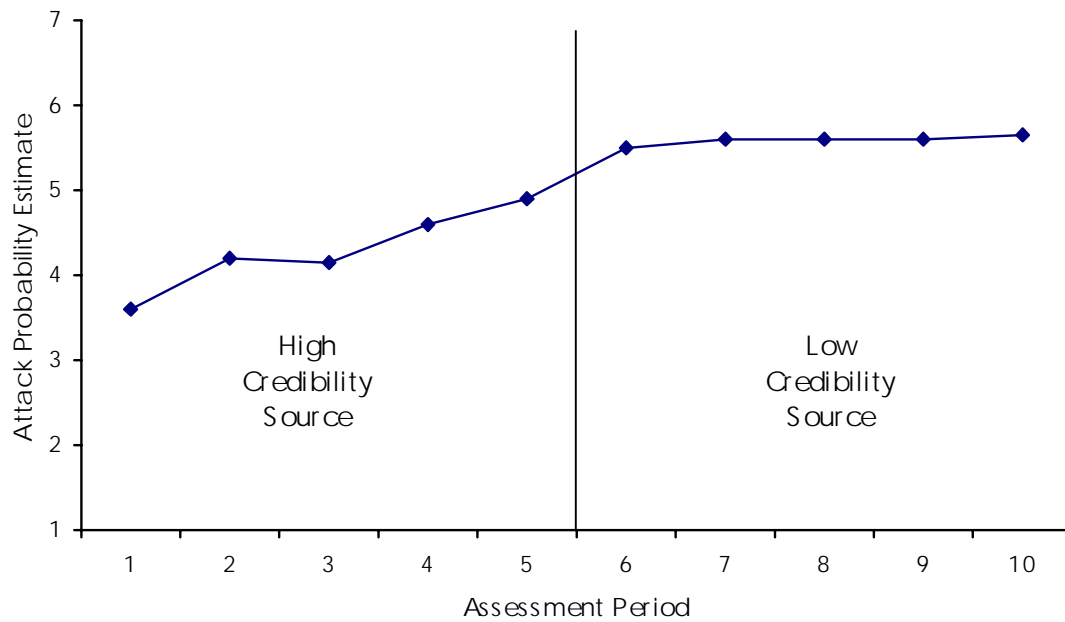
Figure 17. Likelihood estimates for attack when high-credibility sources presented pro-attack critical messages in first half of experiment.
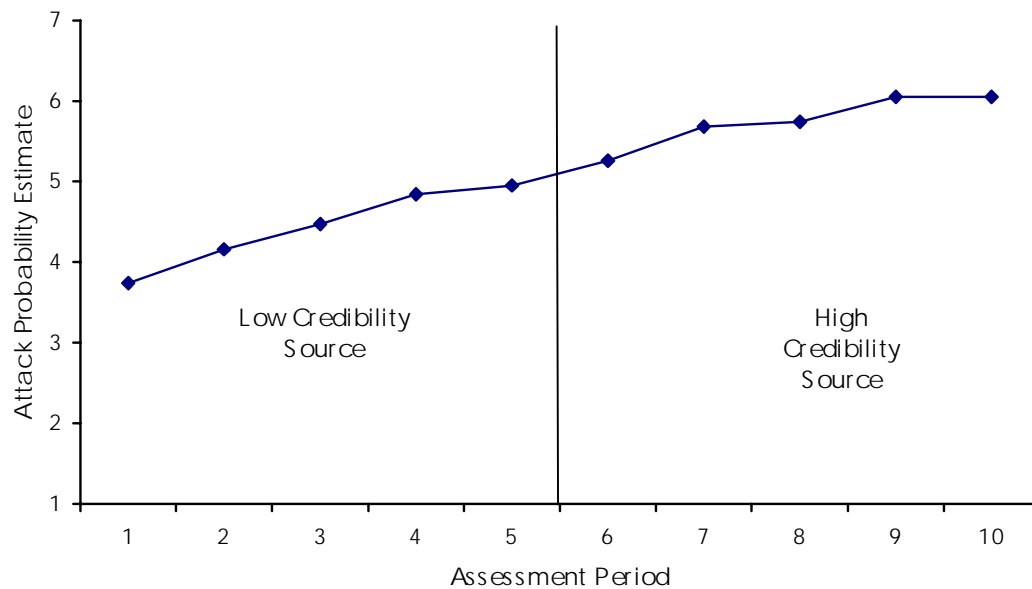
Figure 18. Likelihood estimates for attack when low-credibility sources presented pro-attack critical messages in first half of experiment.

Figure 18 shows that the same general pattern emerged when lower credibility sources were initially used to present critical messages. In this case, there were two significant main effects for source credibility and block, but no higher order interaction. Likelihood estimates in the first half increased at a greater rate than they did in the second half, and likelihood estimates in the second half were higher

than in the first half. Evidently, higher rates of change occur in the early stages of assessment, regardless of the level of source credibility. The fact that the critical messages in the first half were conveyed by low-credibility sources did not discourage the using that information to assess the situation.

These findings are noteworthy because they show that participants were most influenced by information received in the first half of the study, regardless of whether it came from a high- or low-credibility source. One interpretation of this finding is that participants' needs to generate a situation assessment outweighed consideration of the accuracy and reliability of the information upon which they based that assessment. The early stages of situation assessment would therefore seem to be the most influential in generating an assessment, regardless the credibility of the source. This tendency to learn about situations as soon as possible after encountering them might also influence how much subsequent information is weighted.

Note that participant comments during the post-experiment debriefing regarding how they viewed source credibility did not match these findings. Most participants claimed that the message source was either moderately or decidedly important in determining their likelihood estimates for attack. These claims did not vary significantly by culture cluster. In addition, participants overwhelmingly chose the high-credibility source as the one they trusted most. However, their responses during the experiment indicate that the need to learn about a situation took precedence over the credibility of the message source. There seems to be a self-imposed need to assess a situation early, even if that assessment is based on messages originating from a low-credibility source. An important implication of this finding for information operations is that information from questionable sources might have more influence than previously assumed, especially if this information occurs early in a situation assessment task.

Rank Status

The four e-mail messages that were interjected during the experiment enabled rank status issues to be discussed in Hofstede cultural dimensions. A basic question was whether participants would change their evaluations in a predictable way with respect to the superior and subordinate rank status of the analysts who provided feedback. An analysis conducted on the percentage of participants who changed their initial evaluations after receiving feedback was statistically significant (Cochran's Q). Figure 19 shows that, as expected, the fewest changes occurred when the superior and subordinate agreed with the participant, and that the most changes occurred when both disagreed with the participant. These results were expected based on a simple "majority rule" model of decision-making that did not vary significantly by culture cluster. The two mixed conditions (superior and subordinate disagree) generated results that more directly addressed rank status issues. Pairwise comparisons (McNemar Test) of these conditions with the condition where superior and subordinate disagreed found significantly fewer changes in both former conditions. Although approximately three times more evaluations were changed when the superior rather than the subordinate disagreed with the participant, this difference was not statistically significant.
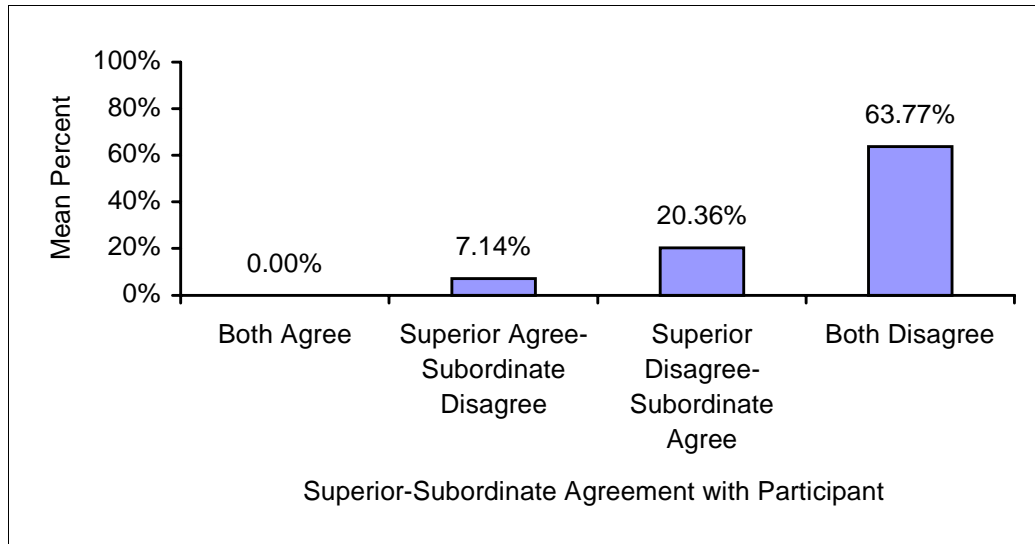
Figure 19. Percentage of participants who changed their evaluations by four superior-subordinate agreement-disagreement combinations.

Power Distance

It was hypothesized that when the dissenter was a superior, participants from high Power Distance cultures (clusters 4 and 7) would change their evaluations more frequently than participants from a low Power Distance culture (cluster 9). The rationale for this prediction was that people in high Power Distance cultures were trained as more deferential toward those in superior positions in an organization than people in low Power Distance cultures. Figure 20 shows that the predicted pattern of results was obtained, although the differences between the two groups were not statistically significant. More than 26% of participants from high Power Distance cultures (clusters 4 and 7) changed their initial evaluations when the superior disagreed with it, compared to just 8% of the participants from the low Power Distance culture (cluster 9).

Figure 21 shows the percentage of changed evaluations when the subordinate rather than the superior disagreed. It was hypothesized that participants from a low Power Distance would change their evaluations more frequently than participants from a high Power Distance culture. The rationale for this prediction was that people from low Power Distance cultures, having a more egalitarian perspective, would tend to accept input from subordinates more readily than would people from high Power Distance cultures. However, participants from high Power Distance cultures changed their evaluations more often than participants from the low Power Distance culture, although this difference was not statistically significant. The percentages were much lower in both cases. None of the participants from the low Power Distance culture and only 10% of those from the high Power Distance cultures changed their evaluations when the subordinate disagreed with them.
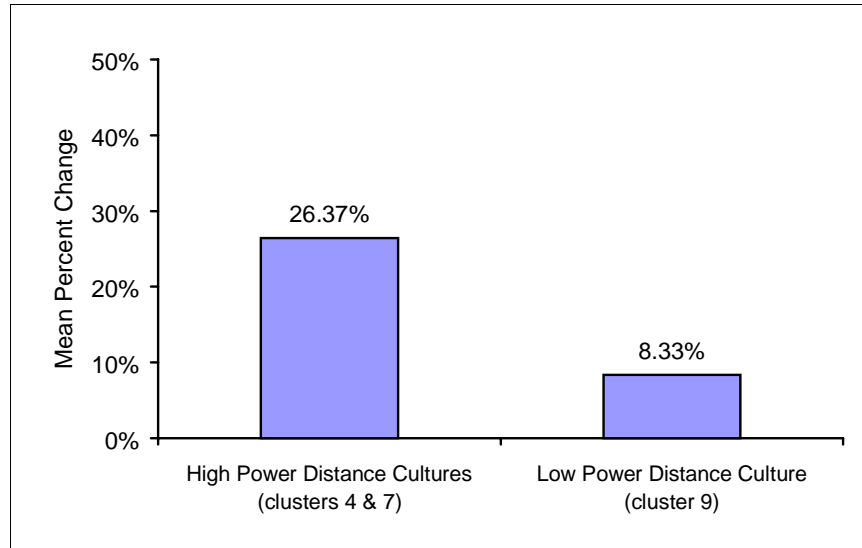
Figure 20. Percentage of changed evaluations by high and low Power Distance cultures when only superior disagreed.
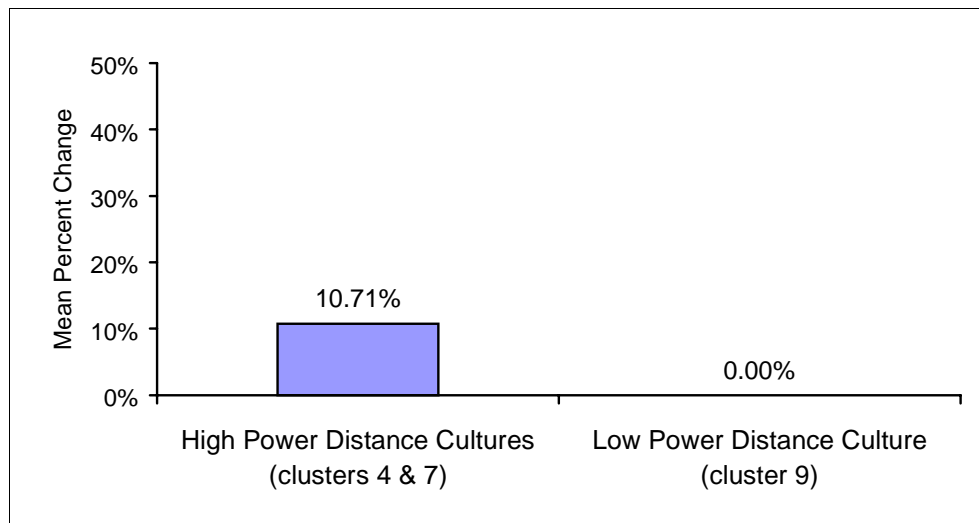

Figure 21. Percentage of changed evaluations by high and low Power Distance cultures when only subordinate disagreed.

Uncertainty Avoidance

Uncertainty Avoidance was the second Hofstede dimension that was discussed in terms of rank status. Participants from a high Uncertainty Avoidance culture (cluster 4) were hypothesized to change their evaluations more often than participants from low Uncertainty Avoidance cultures (clusters 7 and 9). The rationale for this prediction was that uncertainty instilled by disagreement of a co-worker would be reduced by changing one's decision to be consistent with the other. Figure 22 shows the findings which, while not statistically significant, exhibited the hypothesized trend.
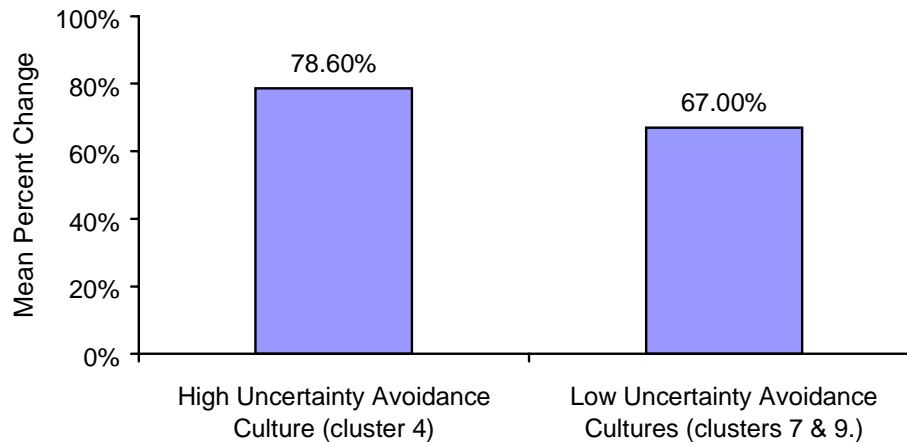

Figure 22. Percentage of changed evaluations by high and low Uncertainty Avoidance cultures.

These findings show the power to influence decisions that exists within a group, especially in ambiguous situations. A stated majority position might result in a change of decision by a minority, a change that is not necessarily warranted. Furthermore, military membership seems to exert more influence on task performance than Uncertainty Avoidance and Power Distance, especially when those tasks are highly specific to military organizations.

The findings of this experiment increased our understanding of the effects of organizational factors on situation assessment and how those effects interact with cultural dimensions. For a more detailed discussion of these findings, refer to Heacox, Gwynne, and Sander (1999).

These findings, along with those from the other two experiments and the decision heuristics questionnaire, can be incorporated into databases that relate cultural characteristics and organizational factors to decision-making variables. The following chapter describes the initial efforts of the CADM project to develop an online, searchable database that provides decision analysts with a tool for accessing, evaluating, and applying knowledge regarding cross-cultural aspects of decision-making.

THE DECISION-MAKING ANALYSIS AND RESEARCH TOOL

Based on the empirical findings reported in the previous sections and extensive reviews of the technical literature on cross-cultural decision-making, an online, searchable database was designed and constructed. This database is called the Decision-Making Analysis and Research Tool (DMART). A primary motivation for developing DMART was to organize and codify project findings and related information on cultural factors that influence decision-making. The concept is to provide assistance to a decision analyst in managing information resources, analyzing diverse data, and formulating courses of action to meet the needs of many types of missions.

DMART, Version 1, is a demonstration tool for decision analysts to access and inter-relate information contained in the project database. DMART, Version 2, also a demonstration tool, also allows the analyst to evaluate implications of database contents for specific decision situations. Long-range plans for future versions of DMART focus on expanded capabilities such as links to information networks that are shared by local and remote analysts.

COLLECTION OF SOURCE MATERIALS

As a first step in the collection of source materials, research literature on individual and group decision-making was reviewed extensively. The principal objectives of this literature review included the following:

- Characterize the major decision heuristics and the biases that can arise from them

- Evaluate the organizational structures that can influence decision-making by individuals and groups

- Identify the cultural factors that affect decision making differentially across cultural groups

These factors were focused upon because of the abundance of evidence indicating their importance to military decision-making activities. Research shows that these factors interact with each other to produce effects that would not be expected when each factor is considered in isolation from the others. For these reasons, the resulting database considers both the singular and interactive influences of these three factors in applied decision-making situations.

Decision heuristics, to briefly review, often facilitate the processing of complex, uncertain, or unreliable information. Heuristics usually simplify the decision process while permitting a valid decision. On some occasions, however, decision heuristics lead to systematic judgmental biases.

Organizational structures that affect decision-making include communication protocol and technology, vertical structure, task specialization, and procedures. These factors were evaluated for their role in the decision process and for interrelationships with decision heuristics. Decision-makers in organizations are bounded by their tasks, roles, and rules, and the type and amount of information that is available in the decision-making process. These organizational factors also reflect values that may predispose the use of certain decision heuristics. The inclusion of organizational structural variables is very important, as they provide the local context in which decision-makers operate.

Risk perception is a culturally based attribute that describes the level of danger attributed to target objects. Research indicates that risk perception might be an important determinant of decisions and that

risk perception varies across cultures. Therefore, literature in risk perception was also reviewed. Particular emphasis was given to its role in cognitive and organizational research on decision-making.

The five Hofstede–Chinese Culture Connection cultural factors, which have been validated through extensive cross-cultural research, provided the foundation for gaining an empirically based understanding of cross-cultural influences on decision-making. Observed relationships among these five factors and organizational structures indicate that cultural values influence the structure of social organizations.

DMART COMPOSITION AND ORGANIZATION

A broad cross-section of information is contained in the DMART database:

- CADM experimental findings
- CADM questionnaire findings
- Decision-making research
- Risk perception research

- Lessons learned from military operations
- Analyses of real-world incidents
- Guidelines for international business and marketing

To codify and organize the information from the literature review in the database, several information categories were developed, including:

- Decision heuristics
- Cultural factors
- Organizational structure
- Risk perception
- Negotiations

- Training
- Lessons learned
- Personality inventories
- Attribution
- Marketing and consumer research

DMART is dynamic; new information is added as it becomes available, and is organized by these categories. The database currently has hundreds of records, chosen for their direct relevance to the aims of the CADM project.

FUTURE PLANS

This project developed an effective approach for conceptualizing and defining culture and for empirically assessing its influence on decision-making. The questionnaire survey and experiments demonstrated that measurable differences in decision-making exist among cultural groups. The cultural background information indicated that these differences could be attributed at least in part to variations in their cultural dimensions as measured by the Hofstede–Chinese Culture Connection dimensions. The structure of the organization in which a decision occurs and the manner in which risks are perceived also play important roles in decision-making.

The experiments conducted in this project established that people from different cultural backgrounds respond differently to decision situations involving uncertain, incomplete, and ambiguous information. The home culture of an individual was associated with perceptual and cognitive factors related to decision-making. Observed differences in decision-making could be related in part to the set of value-based cultural dimensions formulated by Hofstede and the Chinese Culture Connection. These findings add to our knowledge of the effects of information degradation on Command and Control (C^2) decision-making. The demonstration of cultural differences represents a valuable new contribution with important implications for the CADM project and the development of a database linking cultural characteristics to decision-making tendencies. Future research will explore further the relationship between cultural attributes and decision variables to better understand cultural differences in decision-making.

DEVELOPMENT OF INTELLIGENT DECISION-AIDING

The current database was constructed from multiple information sources. Specific criteria were used to select sources that met the multidimensional criteria of the DMART decision support system. DMART will continue to evolve using a 'bot' type software tool. This intelligent retrieval agent will populate the DMART database continuously without requiring any direct intervention from a database manager. An advantage in using a bot is the enhanced ability to detect patterns in large amounts of data. Results from the experiments and questionnaire study have uncovered significant relationships among cultural, decision-making, and organizational variables. A bot can be employed to search for information sources that provide additional detail regarding the relationships among these variables. Pre-defined URLs will be searched and parameters can be modified as needed to re-focus the search of concepts and key words.

Templates can be devised to guide the bot-directed searches. Different templates would be used for various classes of decision tasks. Categories of information used during decision-making and the configurations among these categories will define the content of templates. The templates would be generated from cognitive task analyses of analysts' behavior during the performance of actual and simulated decision tasks. In turn, these templates will provide valuable information about what topics should be given prime emphasis when populating the database. Several levels of detail could be built into the database, making it suitable for various purposes and the basis for templates that can serve the diverse needs of military information analysts.

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